SpeedFam-IPEC

AVANTGAARD™ 676 Chemical Mechanical Planarization System

Maintenance Manual Volume 1 of 4

Revision B.1

June 25, 1999

4409-106227-001 Standard Paper
4409-106227-002 Clean Room Paper

Revision and Change Record

Introduction

The table below summarizes the history of this document. It identifies the issue date, titles and dates of revisions and changes, and affected pages.

Updating Procedure

SpeedFam-IPEC Information Development and Delivery Department and SpeedFam-IPEC Engineering are responsible for the content and accuracy of information in this document. Although effort has been made to create a complete, accurate, and usable document to support SpeedFam-IPEC AvantGaard™ series equipment, quality improvement is an ongoing process.

To report any errors or inaccuracies in this manual, or to recommend quality improvement changes, complete the "Revision / Change Suggestion Form" located at the end of this document and send it to SpeedFam-IPEC Information Development and Delivery.

REV.	CHG.	ISSUE DATE	TITLE
A	N/A	**05/01/97**	AvantGaard™ 676 Maintenance Manual
A.1	Various	**11/01/97**	Update Pages - Refer to TSB# 9711HMSA
A.2	Various	**02/01/98**	Update Pages - Refer to TSB# 9802HMSA
A.3	Various	**06/05/98**	Update Pages - Refer to TSB# 9806HMSA
B	Various	**03/19/1999**	Complete Revision - Refer to TSB# 99676-008
B.1	Various	**06/25/1999**	Adds Russian Translations to Safety - Chapter 3

AvantGaard™ 676 Chemical Mechanical Planarization System

NOTE: **The graphics in this manual are for reference only and may not match the option configurations on the equipment at your site. Refer any questions on optional components to SpeedFam-IPEC Technical Support Services.**

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SpeedFam-IPEC AvantGaard™

Verification of Technical Data

Whenever possible and practical, SpeedFam-IPEC technical manuals, or sections of manuals, are validated at the factory by actually doing the procedures in the manuals. The validation process consists of doing the actual maintenance of the equipment precisely in accordance with the procedures specified in the applicable technical manual. Any required changes or corrections of the technical data, indicated by doing this verification, are then included into the manual.

The following listed sections of this manual have been verified at the factory on the date(s) indicated.

Verified Sections	Method	Verification Date
Control Systems	Simulation	May 01, 1997
Tool Operation	Simulation	May 01, 1997

Technical Assistance

For 24 hour Technical Support, Spare Parts, or Process Engineering, contact SpeedFam-IPEC Technical Support Hot Line at 1-877-NEED-CMP.

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Chapter 1
Introduction

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Manual Contents

Overview

This Maintenance Manual is a functional reference manual for maintenance personnel of the SpeedFam-IPEC AvantGaard™ 676 Chemical Mechanical Planarization System.

Contents

This manual contains the following subjects of interest to maintenance personnel doing repair and maintenance procedures on the AvantGaard™ 676 Tool.

- A Tool Overview that describes the Tool systems and how they function with discussions of the various Tool assemblies, their maintenance, repair, and theory of operation.
- Refer to Chapter 3 for a complete discussion of the possible Safety Hazards and Precautions when using the Tool.
- How to use the Tool.
- A brief discussion of how to use the Control Station computer screens to do the setup, operation, and control procedures for the Tool, and how to edit (change) process parameters. (Refer to the AvantGaard™ 676 User Manual for a complete explanation of the User Operational Interface.)
- A listing of the System Messages and Alarms and description of each.
- A complete list of the Calibration and Alignment Procedures, Corrective Maintenance and Preventive Maintenance procedures for the Tool.

About This Manual

The first page of each chapter contains a Table of Contents for the chapter, with a hyperlinked list of the subjects contained in the chapter.

Refer to the Index at the end of each manual to locate specific topics.

Equipment Description

Introduction The SpeedFam-IPEC AvantGaard™ 676 Chemical Mechanical Planarization System is used during the semiconductor manufacturing process to planarize individual layers in complex integrated circuits to customer specific parameters. The system (Tool) has four wafer planarizers, an endpoint detection system, dual pad conditioning systems, a fully automated cassette to cassette (C2C) system to move the wafers, and a separate Electrical Cabinet.

Cassette to Cassette (C2C) The C2C system uses a multi-axis robot with a wafer pickup safety paddle. A computer controlled robot loads, unloads, and transports wafers from location to location in the Tool. The C2C system includes a spray box assembly used to remove slurry particulate, an automated wafer handling robot, and a wet cassette assembly with a dual cassette basin capable of holding two 25 wafer cassettes. The C2C wafer sensing mechanism automatically senses the number of wafers loaded into the cassettes and communicates the count to the system control (SysCon) computer.

SysCon Computer Each of the Tool systems are controlled by independent processing units linked through a master System Control (SysCon) computer for overall system control. Logic control systems and the low voltage and high voltage electrical panel assemblies are located in a separate Electrical Cabinet. The Electrical Cabinet is typically located on the chase (back) side of the Tool. Sub-floor electrical, pneumatic, and plumbing lines connect the Tool, Electrical Cabinet, and facility resources.

Operation The Tool is operated using the Control Station on the front (operator) side of the Tool. The operator uses a light pen and the monitor to interact with system software and control system functions. Diagnostic and maintenance procedures are controlled at a similar station on the Electrical Cabinet. The Electrical Cabinet Control Station has both a light pen and keyboard interface.

Wafer Fabrication Process

Introduction The AvantGaard™ 676 Tool plays a very important role in the process of moving wafers through various integrated circuit production steps. With each process stage, the wafer becomes more and more valuable. It also becomes increasingly critical for process Tools to do their work with precision. The Tool polishes specific layers of metal off the top of the wafer and maintains as “planar” a surface as possible.

Processing During wafer fabrication, metal layers are deposited on the wafer to fill patterned through holes and trenches outlined by oxide layers. When filled with metal, these holes and trenches become bridging contacts that connect various components throughout a multiple layered device. Oxide layers, known as ILD (InterLayer Dielectric), insulate between each metal layer and, when etched, contain the connective patterns which are filled by the next metal layer. After the ILD is overlaid with metal, the wafer must be polished to remove excess metal (down to the ILD surface) so the metal remains only in the etched patterns. This polishing process, Chemical Mechanical Planarization (CMP), is used to make the wafer surface as flat, or planar, as possible.

CMP CMP occurs through a combination of mechanical and chemical action. Mechanically, the wafer is positioned between two heads that apply specific pressures and a polishing motion calculated to maximize planarization. Chemically, the action of the slurry affects the surface layer. The abrasive slurry on the surface of the pad in combination with pressure and velocity remove the softened surface layer and the slurry fluid carries the removed material away. This exposes a fresh surface layer and the process starts over.

continued on next page

Wafer Fabrication Process, continued

Head Assemblies

When the head assembly has closed onto a wafer, the upper head will begin to rotate. Internal bearings allow the head to spin in the assembly. The wafer head rotates at a speed that is variable from recipe to recipe but seldom exceeds 10 RPM. The lower head also begins to move in the opposite direction in a wave generating path. Speeds are adjusted in the polish recipe to achieve optimal results for various types of polish procedures and materials. The speed of the polish head is faster, but is directly proportional to the rotational speed of the wafer head. (15.9743 to 1 ratio)

continued on next page

Wafer Fabrication Process, continued

Polish Dynamics

Two 208V 3-phase motors are used in each MP assembly, one for the wafer head, and one for the polish head. These motors move the heads and are controlled through the high voltage MP panel assemblies in the Electrical Cabinet. Although independent motors drive the two assemblies, they are connected to the same inverter. Refer to the IPB for a complete breakdown of the MPs and the high voltage MP panel assemblies.

Fluids are supplied to the polish process through the polish pad. The pad has 61 small holes that introduce measured quantities of slurry and DI water to the process. The combination of polish pad motion, pressure, and the chemical properties of the slurry being used cause the wafer to be polished. Polish recipes (chosen by the operator) control polish parameters, including polish time, slurry mixtures, polish and wafer pressures, and motor speed.

The end of the wafer polishing procedure is determined either by recipe, or by an optional Endpoint Detection System computer monitoring the polishing process. Changes in the polishing process signal an endpoint and the computer stops the process.

Testing Polishing Outcomes

After the polishing process is done, operators can do several testing procedures on the wafers to make sure that process specifications have been met. Testing can give an indication of Removal rate, Uniformity, and Particle contamination.

Removal

Average removal rate is the average rate of tungsten removal during polishing. It is measured in angstroms per minute using either a ResMap or OmniMap metal thickness measuring Tool.

continued on next page

Wafer Fabrication Process, continued

Uniformity

Uniformity is a measure of how consistent the removal rate is across the wafer. Uniformity (or more accurately, non-uniformity) is calculated by multiplying the sample standard deviation by 3, and dividing by the average removal rate.

Both removal rate and uniformity are calculated. The Tool uses a 4 point probe to obtain sample data from the wafer.

continued on next page

Wafer Fabrication Process, continued

Particle

Particle contamination can be detected using a “Surfscan®” Tool, which scans the surface of a wafer to detect evidence of contamination. Because contaminant particles are extremely small, the SurfScan® Tool uses a laser to reflect light off the surface of the wafer, then analyzes the light diffraction patterns to identify and locate existing particles. Process engineers post limits on the number of particles that are acceptable per wafer. This figure is known as the upper control limit, or UCL. SurfScan® measurements can be done periodically to make sure the contamination level of wafers moving through the Tool.

Tool Operation

Introduction The tool is typically run from the control station on the front (operator) side of the tool. The operator uses a light pen and monitor to interact with system software and control system functions. Diagnostic and maintenance procedures can be controlled at a similar station on the Electrical Cabinet. The Electrical Cabinet control station has both a light pen and keyboard interface.

The wafer polishing process begins when the operator loads a wafer cassette into the wet cassette loading arm. Wafer cassettes can be loaded by hand or by an automated handling system. The operator makes the appropriate menu selections with the light pen on the control monitor screens to control the polishing process.

After loading the wafer cassettes, the operator door closes, isolating the operator from the polishing process. The operator selects a polishing recipe. The operator then selects Process from the Carriers dialog box, and the Tool will then process all wafers in the scanned wafer cassette.

continued on next page

Tool Operation, continued

Table 1-1. Routine Polish For Each Individual Wafer

Step	Instruction
1	The robot receives a request for a wafer from an MP polish head.
2	The robot picks a wafer, on the device side, aligns it against the alignment pins, then loads the wafer into the wafer head.
3	Wafer head vacuum comes on. When the sensor “sees” the wafer, it signals the computer and the robot receives a signal to release the wafer and move to a safe area.
4	The wafer head lowers to the polish head and wafer vacuum is disabled.
5	The polish process begins. The wafer head rotates while the polish head orbits, slurry and DI water are introduced between the two heads, and pressures are applied, producing the Chemical Mechanical Planarization (CMP) process.

continued on next page

Tool Operation, continued

Step	Instruction
6	When the polish cycle is over, the wafer head will enable wafer air, then raise, leaving the wafer, device side down, on the polish pad.
7	If there is another wafer to be polished, the robot will load it, then move down to pick up the wafer on the polish pad.
8	Pad air will come on to break the surface tension between the polish pad and the wafer, allowing the robot to pick up the polished wafer.
9	The robot will then place the polished wafer in the Spray Box to be rinsed.
10	When the Spray Box cycle is completed, the robot will pick up the rinsed wafer and return it to its original position in the wafer cassette.

Operating the Tool

See “Tool Operation” on page 4-1 in the User Manual, for additional information about operating the Tool, and “Operational Interface” on page 5-1 in the User Manual, for additional information about the System Control (SysCon) computer screens. See “Service Mode Operations” on page 4-1 in the Maintenance Manual, for information about operating the Tool in Service Mode.

Danger, Warning, Caution, and Note Icons

Definitions

To emphasize and to make clear the importance of Danger, Warnings, Cautions, and Note icons in the manual and on the AvantGaard™ 676, the definitions and formats shown on the following pages are used. If you do not pay attention to them, and the safety information they contain, you can be injured, lose your life, or damage the product or the Tool. Refer to Chapter 3 for a complete discussion of Tool safety hazards and precautions.

In the AvantGaard™ 676 manuals, all Dangers, Warnings, and Cautions are located directly above the text to which they apply, and Notes are located directly below the text to which they apply. Refer to page 3-6 for descriptions.

DANGER - THESE SYMBOLS ARE USED IN THE MANUAL, AND ON LABELS IN THE TOOL, TO ALERT THE USER TO THE PRESENCE OF DANGEROUS VOLTAGE, WITHOUT INSULATION, IN THE MACHINE'S ENCLOSURE(S). PERSONAL INJURY OR LOSS OF LIFE WILL RESULT IF PROPER OPERATING PROCEDURES, PRACTICES, ETC. ARE NOT CORRECTLY FOLLOWED.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

WARNING - THESE SYMBOLS ARE USED IN THE MANUAL, AND ON LABELS IN THE TOOL, TO ALERT THE USER TO THE PRESENCE OF PINCHING AND CRUSHING HAZARDS. PERSONAL INJURY OR LOSS OF LIFE CAN RESULT IF PROPER OPERATING PROCEDURES, PRACTICES, ETC. ARE NOT CORRECTLY FOLLOWED.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

	CAUTION - This symbol is used in the manual, and on labels in the Tool, to alert the user to the presence of important operation and maintenance information, which, if not strictly observed, can result in damage to, or destruction of, equipment.
	CAUTION - This symbol is used in the manual, and on the Tool, to alert the user to the presence of chemical risk or hazard of an operating procedure or practice, which, if not correctly followed, can result in personal injury or bodily damage to personnel.
NOTE:	**This symbol is used in the manual to alert the user to additional information, operating procedures, or conditions, which should be read and understood to aid in the use operation, or maintenance of the wafer polisher.**
	This symbol (protective conductor terminal) is used to identify terminals in the Tool that are connected to the Tool's Protective Bonding Circuit by a conductor with a color other than the bi-color GREEN-AND-YELLOW. The Tool's Protective Bonding Circuit is connected to an external protective earth ground for safety purposes.
PE	**This designation is used to identify the ONE terminal in the Tool that connects the Tools protective Bonding Circuit to the external protective earth conductor of the incoming supply system. This designation is used with a Protective Bonding Circuit icon shown above.**

continued on next page

Danger, Warning, Caution, and Note Icons, continued

This symbol (functional earth terminal) is used to identify a terminal in the Tool that is intended to be earthed for any functional purpose OTHER THAN SAFETY.

How to Use the CD-ROM

Introduction This set of manuals is available CD-ROM. The CD-ROM allows you to:

- View movies.
- Quickly navigate and search for material using hypertext linking.
- Use FrameViewer® to add notes directly on specific pages in the electronic manual.
- Use the electronic manual in a clean room environment without special paper.
- Print out update or reference pages, as required.

Requirements To view the CD-ROM version of the manuals, you should have a minimum of the following computer hardware and software:

- IBM® compatible personal computer with 486 DX2-66 Processor
- Microsoft® Mouse or compatible pointing device (mouse recommended)
- 2x speed CD-ROM drive (10x recommended)
- 16 MB RAM (24 MB recommended)
- 24 MB available hard-disk space (30 MB recommended)
- Microsoft® Windows® 95 or higher or Windows NT®
- FrameViewer® 5.5 (Included on the CD - see Table 1-2)

Loading the CD-ROM Before the CD-ROM manuals can be viewed, you must install FrameViewer® 5.5, from the AvantGaard™ 676 CD-ROM. Do the steps in Table 1-2 to install FrameViewer® software. Then do the steps in Table 1-3 to view the manuals on the CD-ROM.

continued on next page

How to Use the CD-ROM, continued

Installing the Viewer

Table 1-2. Installing FrameViewer® 5.5

Step	Instruction
1	Close all open programs.
2	Insert the CD-ROM in the drive. If your Windows® 95 or higher AutoStart feature is active, the FrameViewer® 5.5 software will automatically load/start. If the software AutoStarts, continue from Step 8. If the software does not start, go to Step 3.
3	Click on Start, then on Run.
4	Click on Browse, then click on Look in.
5	Choose the CD-ROM drive (for example E:).
6	Click on the file named Autoload.exe, then click on Open.
7	Click OK.
8	Click on Next.
9	Read the license agreement, then click on Yes.
10	Select Registered Owner Version, then click on Next.
11	Enter your name and company information, then click on Next.

continued on next page

How to Use the CD-ROM, continued

Step	Instruction
12	Make sure the information is correct, then click on Yes.
13	Click on US English, then click on Next.
14	Click on Next.
15	Click on Yes.
16	Click on Typical, then click on Next.
17	Make sure the current settings are correct and if OK, click on Next. (FrameViewer® 5.5 files will be loaded.)
18	Deselect the “Yes, I want to view the ReadMe file now.” check box, then click on Finish.
19	Click on OK.
20	Click on Yes.

continued on next page

How to Use the CD-ROM, continued

Viewing the CD-ROM

If your Windows® 95 or higher AutoStart feature is active, the FrameViewer® 5.5 software will automatically load/start. If the software does not start, do the following steps.

Table 1-3. Viewing the AvantGaard™ 676 CD-ROM

Step	Instruction
1	Click on Start, then navigate through Programs to Adobe FrameViewer® 5.5.
2	Click on Adobe FrameViewer® 5.5.
3	Click on File in the menu bar (upper left-hand corner).
4	Click on Open.
5	Choose the CD-ROM drive. (for example E:).
6	Open the file called Start.fm in the root directory.
7	Click on the picture of the Tool to see a movie, or the Main Menu button to display the Main Menu.
8	Click on the menu buttons to display different screens. When the mouse pointer is moved over the Hyperlinks, or movies, it will change to a hand. Click on these areas or any blue text to make a Hyperlink jump or start the movie. To stop a movie, push ESC, or click next to it.

NOTE: **Complete help information is also available under Help on the FrameViewer® menu bar. Also, refer to Questions or Display Problems, as necessary.**

How to Use the CD-ROM, continued

Display Problems	Irregular text and images may be displayed if the user's computer system does not have a Hewlett Packard laser jet printer driver installed. The preferred driver is one of the HP5 drivers. Load the driver following the instructions in the Windows® User Guide under an unused port. If an HP5 driver is not available, one is located on the CD-ROM in the printer subdirectory. If colors appear mottled or splotchy when viewing pictures or menus, change the number of colors for your display to 64K or above.
FrameViewer 5.5® Features	FrameViewer® 5.5, included on the CD-ROM, gives you the ability to create your own notes or bookmarks and watch movies on this CD-ROM. After installing FrameViewer® 5.5 you can add a note or bookmark or watch a movie in the 676 manuals.
Movies	One of the features of FrameViewer® 5.5 is that you can **view movies** on the CD. Click on movies to start playback. To stop a movie, push ESC, or click next to it.
Questions	Please direct all questions or concerns to SpeedFam-IPEC Information Development and Delivery: • Voice 1-877-NEED-CMP, or 1-480-961-1600 • 305 North 54th Street, Chandler, AZ 85226-2416

Additional Manuals

Additional Manuals

Table 1-4 lists the manuals available for the AvantGaard™ 676 Chemical Mechanical Planarization System. Contact SpeedFam-IPEC Information Development and Delivery for additional copies of these manuals.

Table 1-4. Additional Manuals

Name	Number	Description
AvantGaard™ 676 Illustrated Parts Breakdown	4409-106225	An illustrated parts breakdown of the assemblies and components in the AvantGaard™ 676.
AvantGaard™ 676 Maintenance Manual	4409-106227	A handbook and reference manual for maintenance personnel.
AvantGaard™ 676 User Manual	4409-106226	An operational handbook and user reference manual for the AvantGaard™ 676.
AvantGaard™ 676 Installation Guide	4409-106228	Instructions and facility requirements for proper installation of the AvantGaard™ 676.
AvantGaard™ 676 Computer Host Interface Manual	4409-106220	Information about the optional serial communication interface. (The interface conforms to the SECS I/II protocol standard.)
AvantGaard™ 676 CD-ROM Manual Set	4409-106224	A CD-ROM containing the AvantGaard™ 676 Illustrated Parts Breakdown, Maintenance and User Manuals.

Notes:

Chapter 2

Tool Overview

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Tool Dimensions

Introduction This section gives information about the size and dimensions of the Tool. Use this information when moving or installing the tool. This information should also be referenced when preparing the site for production and maintenance of the tool.

Dimensions The tool has two major assemblies, the Main Tool and the Electrical Cabinet. The Main Tool mounts flush into a bay chase wall. The Electrical Cabinet can be located directly behind the tool with a minimum clearance of 36” (91.4 cm). Table 2-1 lists the outside dimensions of the Main Tool and the Electrical Cabinet. Refer to Figure 2-1 for exterior views of a typical Main Tool, and Figure 2-2 for a view of the Electrical Cabinet.

Table 2-1. Tool Dimensions

EQUIPMENT	Height	Width	Depth
Main Tool (without Hoist)	96" (243.8 cm)	82" (208.3 cm)	69" (175.3 cm)
Main Tool (with Hine Robot Option)	102” (289.5 cm)	82" (208.3 cm)	69" (175.3 cm)
Main Tool (with Hoist Option)	108” (274.3 cm)	82" (208.3 cm)	69" (175.3 cm)
Main Tool - Center of gravity	47.5” (120.7 cm)	38” (96.5 cm)	24.5” (60.9 cm)
Electrical Cabinet	88” (223.5 cm)	88” (223.5 cm)	24” (61.0 cm)
Electrical Cabinet - Center of gravity	40” (101.6 cm)	44” (111.8 cm)	14” (35.6 cm)

continued on next page

Tool Dimensions, continued

MAINTENANCE CLEARANCE	Total Height	Chase Side	Left/Right	Back Side
Maintenance Clearance - Main Tool (with Hoist Extended)	126” (320 cm)	40” (101.6 cm)	20” (50.8 cm)	N/A
Maintenance Clearance - Electrical Cabinet	96” (243.8 cm)	40” (101.6 cm)	N/A	40” (101.6 cm)

Operator and Chase Side Views

Figure 2-1. Operator and Chase Side Views

Electrical Cabinet View

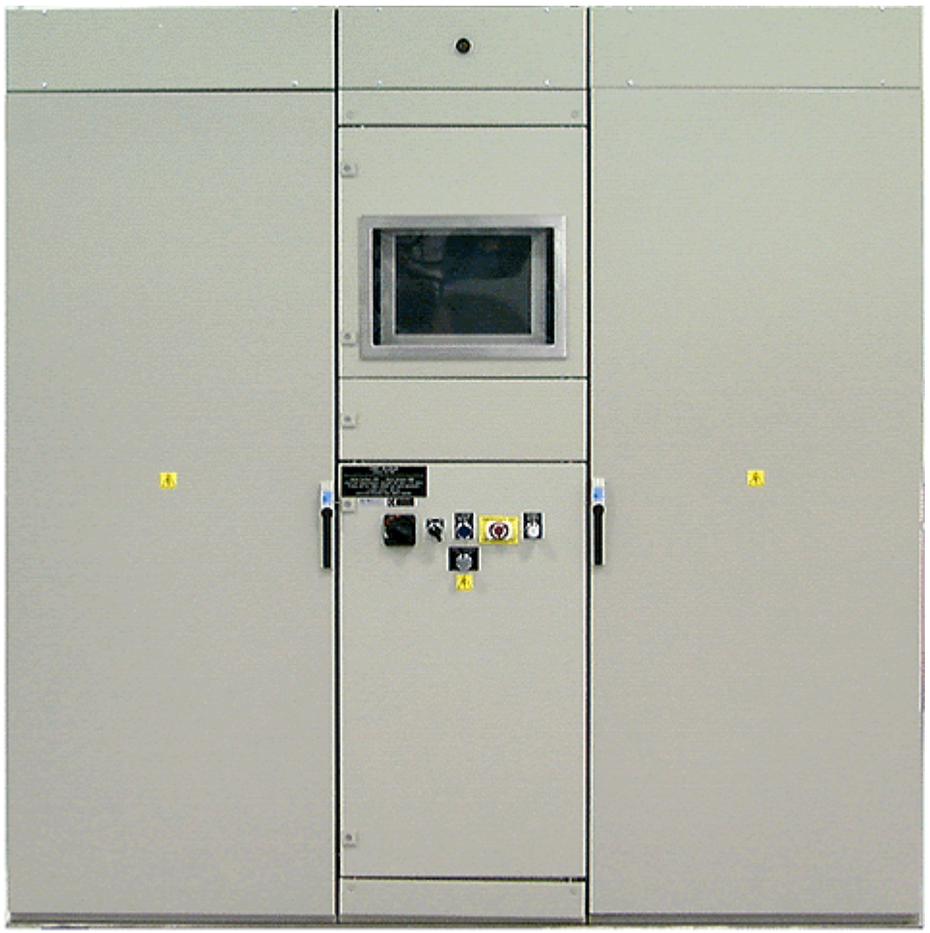

Figure 2-2. Electrical Cabinet

Facility Requirements

Weight

The weight of the complete Main Tool, including exterior panels, is approximately 6500 pounds (2,948 kg). The weight is evenly distributed with each of the four leveling feet supporting approximately 1625 pounds (737 kg). The weight of the Electrical Cabinet is approximately 3500 pounds (1,588 kg). Reinforced flooring is recommended for this cabinet.

Both the Main Tool and the Electrical Cabinet should be mounted on customer supplied pedestals that position the hard mount connections at floor level. Pedestal design may vary from site to site due to Engineering requirements.

NOTE: **Refer to “Moving the Tool” on page 3-94 in the Safety chapter if the Tool or Electrical Cabinet must be moved.**

Electrical Requirements

Tool electrical power requirements are 208VAC, 60 Hz, 60 Amps, 3 phase WYE with a common and ground, and #2, copper THHN 90°C, derate ground to #8 copper, 1-1/4" conduit. The AIC rating for the main breaker on the tool is 65,000 Amps. The largest motor is rated 7.8 FLA. The facility disconnect must be visible from the tool, or capable of being locked in the OFF (open) position.
[S/N 3076, 3078, 3084, 3088] The AIC rating for the main breaker on the tool is 10,000 Amps.

Mounting Requirements

The tool is typically mounted through a bay wall, with the mounting plane flush with the wall. There should be fascia framed on the sides and bottom with a 4" (10.1 cm) wide stainless-steel trim strip that extends out 1" (2.54 cm) on the sides and 1.5" (3.81 cm) from the floor. The fascia will be 76" (193.0 cm) wide and 84" (213.4 cm) tall. Make sure the metal portion of Fab does not contact the Main Tool.

continued on next page

Facility Requirements, continued

DI Facility Requirements	There must be an exterior shut-off on the facility DI water supply line that can be used in case of emergency.
Scrub Sensor	The facility scrub exhaust sensors should be connected with 2# 16 AWG copper THHN 75°C or better, 1/2" conduit.
Facility Exhaust	Table 2-2 gives the exhaust requirements for the Customer facility. Refer to Figure 7-6 on page 7-9 in the Maintenance Manual, for Main Tool Fluids Connections. SpeedFam-IPEC recommends that a Photohelic alarm is used to indicate if scrub exhaust failure occurs.

continued on next page

Facility Requirements, continued

Table 2-2. Facility Exhaust Requirements

Component	Requirement
Air Exhaust Ducts	Nonmetallic fire rated material suitable for water vapor containing acid or bases.
Liquid Exhaust Pipe	Schedule 40, or greater, clear PVC or other cleanroom compatible nonmetallic fire rated material. All liquid exhausts shall be fire rated and suitable for acids or bases. (pH 2 - pH 12)
Liquid Exhaust Tubing	Flexible Teflon® or other cleanroom compatible material.
All Pneumatics, Vacuum Generators, and Polish Heads	Exhaust with 1.5” scrub line.
Electrical Enclosures	Vent with a 3 " PVC pipe to the connection in the side of the Electrical Cabinet near the top. Exhaust flow shall be 75 SCFM.

continued on next page

Facility Requirements, continued

NOTE: **Tool exhaust measurements should be made on a straight section (no less than 5 duct diameters) immediately outside of the tool.**

SpeedFam-IPEC recommends (refer to S2-93 Section 10.9) that the facility monitor the Tool top exhaust with Photohelic devices (or equivalent) and give hardware-based control to stop the flow of fluids to the 676, and supply the status to the Tool.

Environmental Requirements

Tool Requirements

Table 2-3 gives the facility environmental requirements for a typical Tool installation.

Table 2-3. 676 Environmental Requirements

Environment Condition	Requirement
Ambient Operating Temperature	50°F (10°C) minimum to 85°F (32°C) maximum
Relative Humidity During Operation	20% minimum and 60% maximum relative humidity (non-condensing) at 77°F (25°C)
Atmospheric Contamination	Class 100 cleanroom or better
Storage and Shipping Temperature	45°F (7°C) minimum to 122°F (50°C) maximum
Relative Humidity During Storage and Shipping	10% minimum and 90% maximum relative humidity (non-condensing) at 77°F (25°C)
Idle Temperature	45°F (7°C) minimum to 122°F (50°C) maximum
Relative Humidity at Idle	10% minimum and 90% maximum relative humidity (non-condensing) at 77°F (25°C)
Altitude	Recalibration for differences in atmospheric pressure may be required. Contact a SpeedFam-IPEC Field Engineer.

Tool Systems Overview

Tool Systems

There are six main modules or systems in the AvantGaard™ 676. Refer to Table 2-4 for a brief description of each module / system.

Table 2-4. Tool Systems

Module / System	Description
MP Modules	Components directly involved with the wafer polishing process. Refer to page 2-13.
Cassette to Cassette (C2C) System	Components controlling wafer storage, sensing, rinsing, and movement of wafers through the Tool. Refer to page 2-22.
Pad Conditioning System	Cleans and conditions the polish pads. Refer to page 2-38.
Fluids System	Components controlling the supply, distribution, and removal of process fluids and scrub air. Refer to page 2-40.
Electrical Cabinet	Supplies computer / logic control and electrical power distribution and conversion to various Tool components and systems. Refer to page 2-44.
Endpoint Detection Systems	Systems that automatically detect the end of the polish cycle. Refer to page 2-53.

NOTE: **Refer to Chapter 4, Tool Operation and Chapter 5, Operational Interface in the User Manual, as required, for information about operating the Tool in Production Mode.**

MP Modules

Description There are four MP modules in each Tool. The MP modules consist of the components and assemblies that are directly involved in the wafer polishing process.

The major MP module assemblies are the Wafer and Polish Heads, MP Upper Pneumatic Panel Assembly, and the MP Lower Pneumatic Panel Assembly.

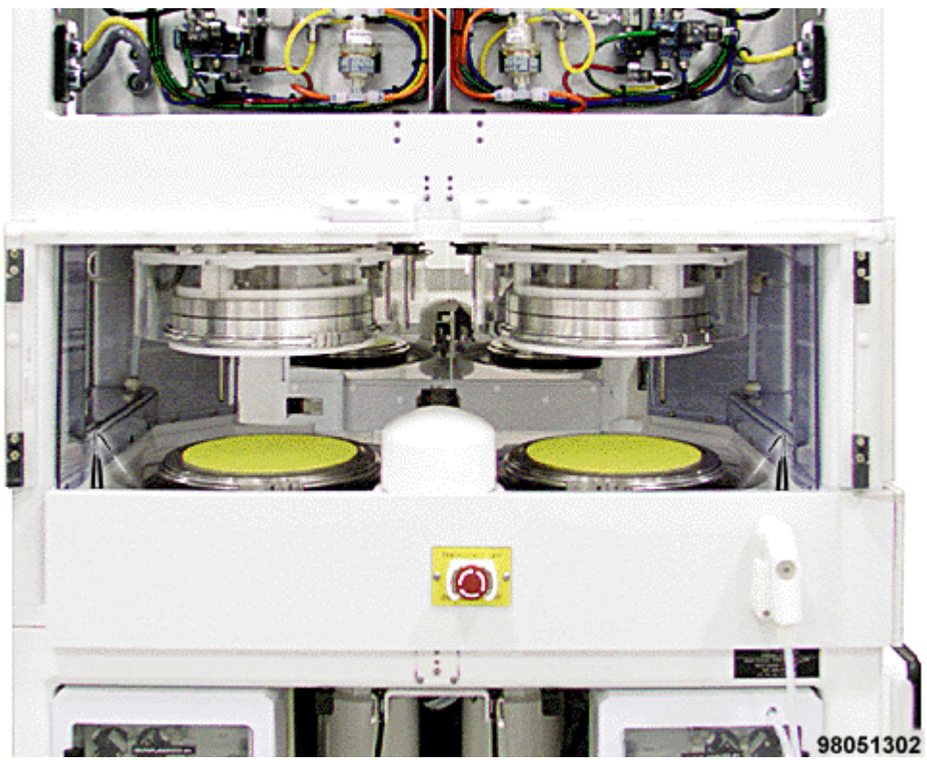

Figure 2-3. MP Modules

Wafer and Polish Heads

Description Two separate head assemblies, the wafer head and the polish head, work at the same time during the wafer polishing process. The upper head is called the wafer head, the lower is called the polish head. Refer to Table 2-5.

Table 2-5. Head Assemblies

Item	Description
Wafer Head	The wafer head is located on the upper half of the Tool, directly over the polish head. Its main function is to position and hold the wafer in contact with the polish head during the polish process.
Polish Head	The polish head is located on the bottom half of the Tool, below the wafer head. Its main function is to supply the orbital polishing action that removes the material from the surface of the wafer. The polish head has a specially designed polish pad attached to its surface, which is the source of the “scouring” friction.

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Wafer and Polish Heads, continued

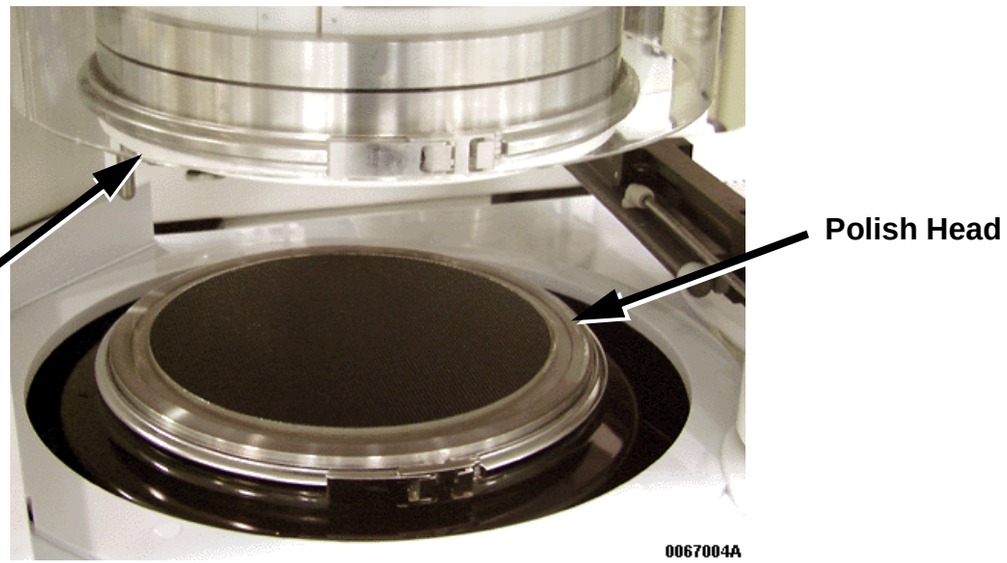

Figure 2-4. Wafer Head and Polish Head

Advanced Pad Motion (APM) Option

Description The Advanced Pad Motion (APM) option adds a rotational, oscillating motion, to the standard orbital motion of the polish head. The APM option consists of software control modifications and four APM assemblies.

Hardware for the APM is installed on each of the polish heads. The hardware is located directly below the polish head, mounted to the Tool base. Each APM unit consists of a stepper motor, a right angle 30-to-1 gearbox and shaft, a mechanical stop, a position sensor assembly, an IDC (Industrial Devices Corporation) SmartStep Controller, and a manual lockout screw.

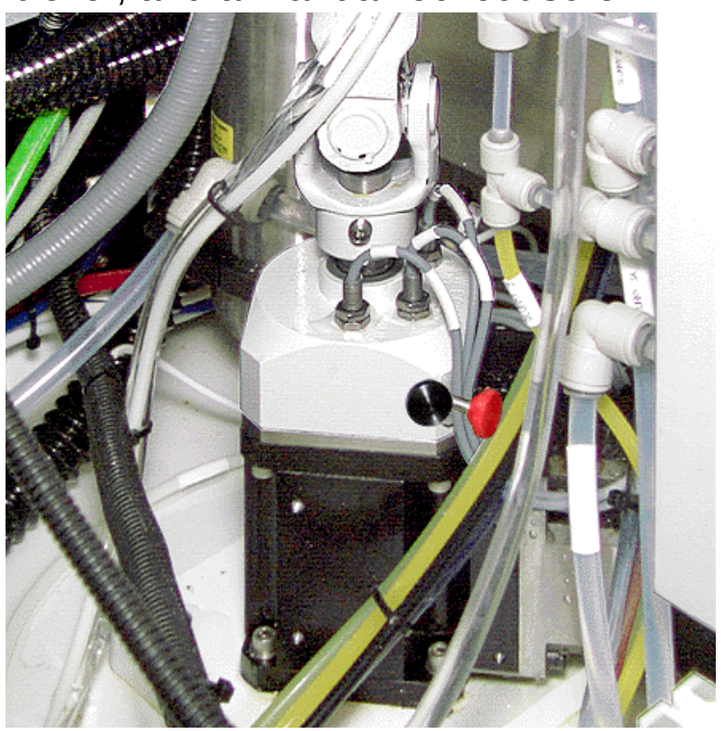

Figure 2-5. Advanced Pad Motion (APM) Option

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Advanced Pad Motion (APM) Option, continued

Operation

The rotational motion parameters are configured through the Tool software screens and can be used during wafer polishing or pad conditioning, or disabled when standard orbital polishing or conditioning is needed. The specific range and angular velocity of the APM can be controlled through inputs in the polishing system recipe editor. This allows for maximum flexibility of the system during process development.

Advantages

The main advantages of the APM option are:

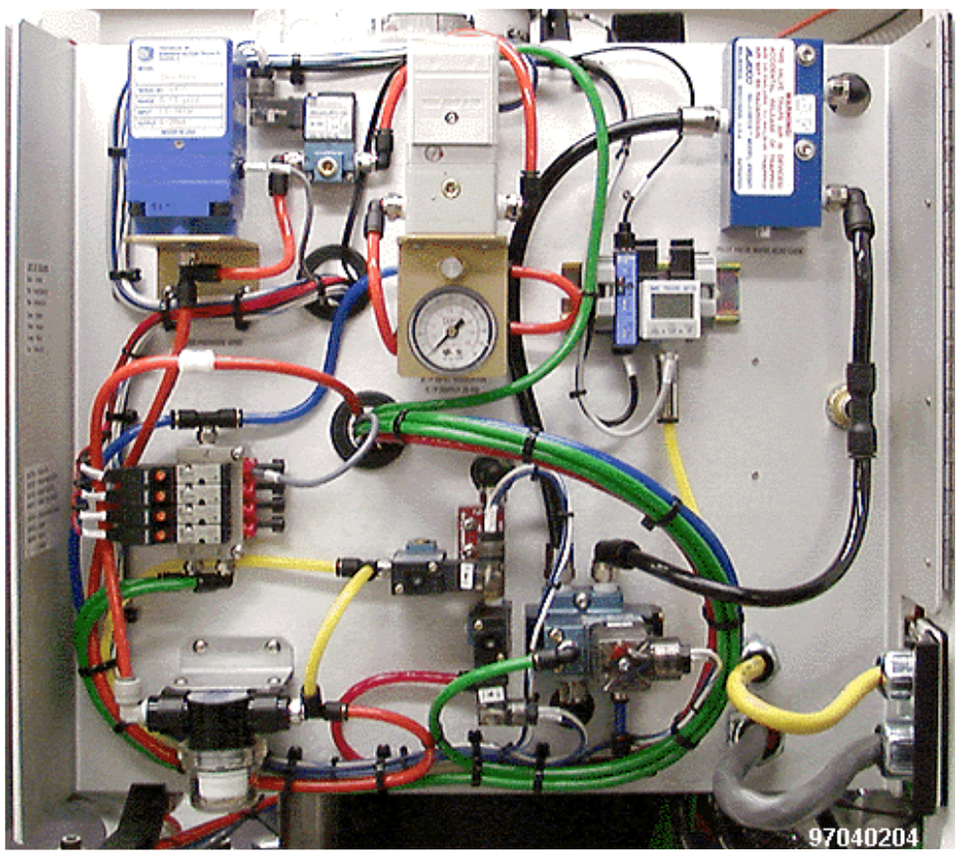
- improved wafer non-uniformity due to the elimination or reduction of the high and low removal rate rings caused by the polish pad X-Y groove pattern
- reduction or elimination of inconsistent removal rate at the wafer center caused by pad orientation, wafer head to polish head offset, and zero rotational velocity of the wafer center
- reduction of center-to-edge non-uniformity caused by non-uniform pad conditioning

Additional Information

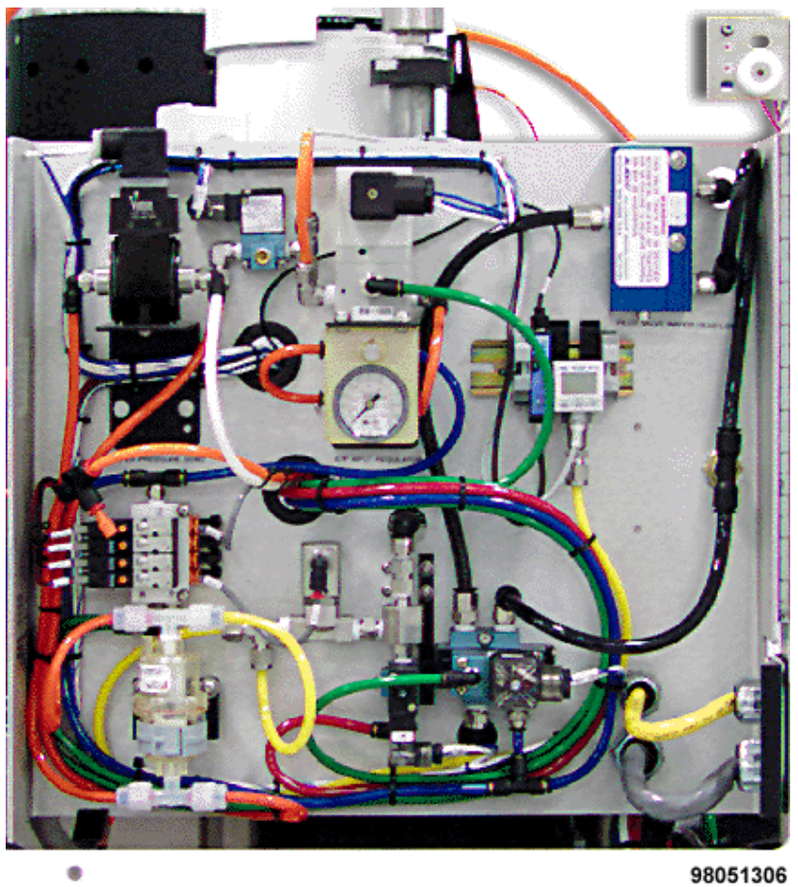
Refer to Chapter 6 in the Maintenance Manual, as required, for additional information about the Advanced Pad Motion (APM) Option.

MP Upper Pneumatic Panel Assembly

Introduction The four MP upper pneumatic panel assemblies supply air and sensor signal routing for the wafer head assemblies. One MP upper pneumatic panel assembly is located on the Tool frame above each wafer head assembly.



Typical MP Upper Pneumatic Panel Assembly



Delta P MP Upper Pneumatic Panel Assembly

Figure 2-6. MP Upper Pneumatic Panel Assemblies

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MP Upper Pneumatic Panel Assembly, continued

Functions

The MP upper pneumatic panel assemblies are used in system operations that occur in the upper half of the Tool in the MP module. There is a separate panel assembly for each MP wafer head.

Primary functions include:

- Raising, lowering, and parking the wafer head.
- Control of wafer vacuum and pressure to the wafer head itself.

The head assembly includes a movable plate that extends outward in response to pressure settings input by the operator. The wafer pad sits on this plate and it's position controls the physical pressure applied to the wafer during polishing. The upper pneumatic panel assemblies supply and monitor this pressure.

Secondary functions:

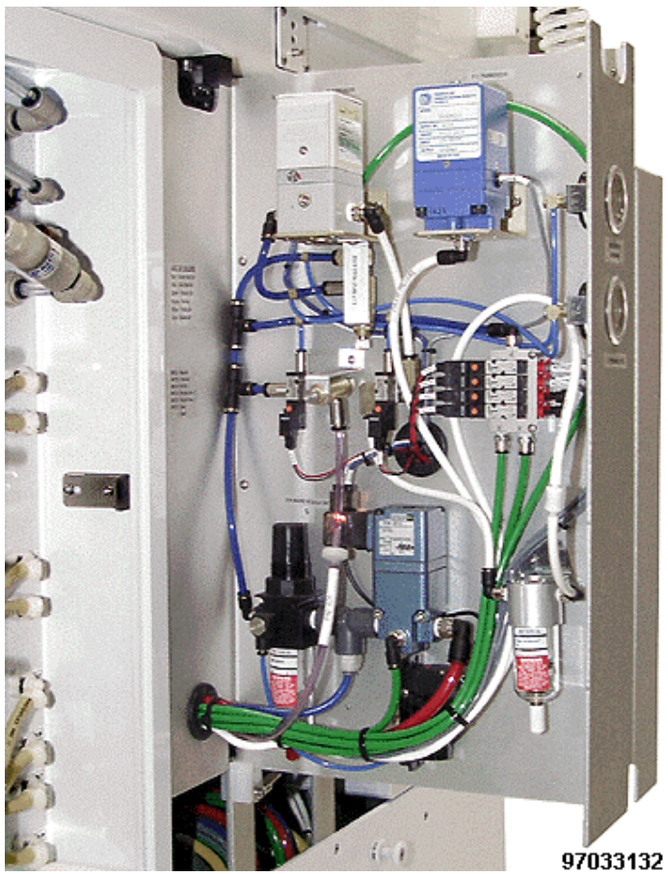
- Monitoring the slurry shield sensors.
- Control the locking mechanism on the side access doors.

Slurry Shields & Bimba Cylinder

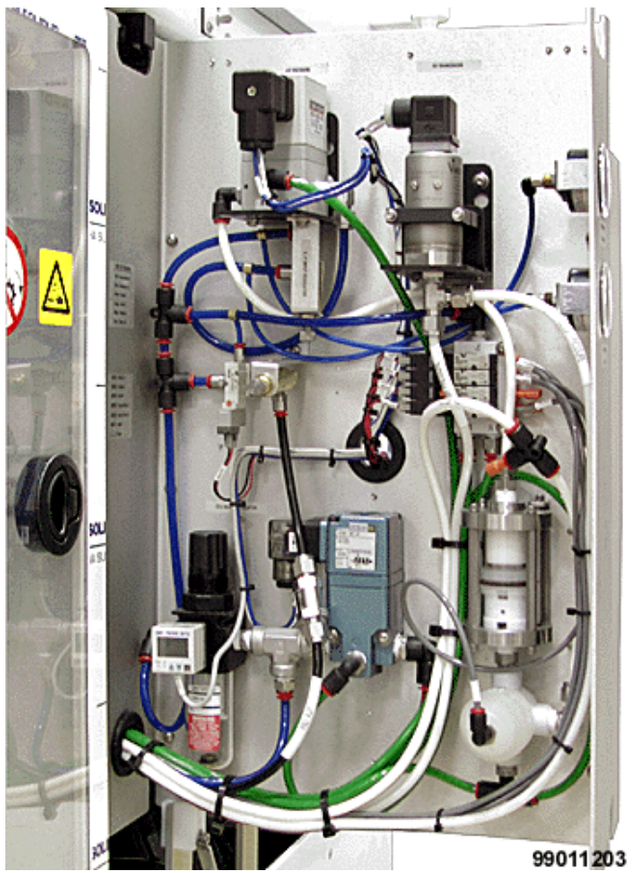
The slurry shield sensors send a signal if the slurry shields that surround the heads are raised or lowered during a polishing cycle. The shields form a barrier around the polish heads to prevent slurry or other matter from being projected outside the polish area. The locking mechanism or Bimba cylinder is a safety device that can be used to prevent the side access doors from being opened during wafer processing. The tool can be configured so these doors automatically lock, in the closed position, while the Tool is operating.

MP Lower Pneumatic Panel Assembly

Introduction The MP lower pneumatic panel assemblies are located on the lower right and left side of the Tool. These panel assemblies are perpendicular to the upper pneumatic panel assemblies and slide in and out on rails for easy access.



Typical MP Lower Pneumatic Panel Assembly



Delta P MP Lower Pneumatic Panel Assembly

Figure 2-7. MP Lower Pneumatic Panel Assemblies

continued on next page

MP Lower Pneumatic Panel Assembly, continued

Functions

There is a separate panel assembly for each MP polish head. These panel assemblies are used in system operations that generally occur in the lower half of the Tool in the MP module.

Primary function:

- Supply and regulation of polish pressure during the polish cycle.

Secondary functions:

- Supply and regulation of air lines for the MP polish head.
- Air filtration.
- Head Park position sensor signal routing.

The pneumatic filtering system cleans incoming air used in the MP lower pneumatic panel assembly. Pad air is supplied and regulated to flow through holes in the polish pad. When a polishing cycle is finished and the wafer head rises off the polish head, regulated air is directed through the pad to break the wafer to polish pad surface tension, so the robot paddle can pick up the wafer.

Cassette to Cassette (C2C) System

Introduction The Cassette to Cassette (C2C) system includes the components and assemblies involved with wafer storage, sensing, rinsing, and movement throughout the Tool. The major C2C components and assemblies are the Wet Cassette Assembly, Wafer Sensor Array, C2C Pneumatic Panel Assemblies, Spray Box Assembly, and the Robot.

Cassette to Cassette (C2C) The C2C system uses a multi-axis robot with a wafer pickup paddle. The robot is controlled by a computer and loads, unloads, and transports wafers from location to location in the Tool. The C2C system also includes a wafer sensor head that automatically senses the number of wafers loaded into the cassette and communicates the count to the system control (SysCon) computer.

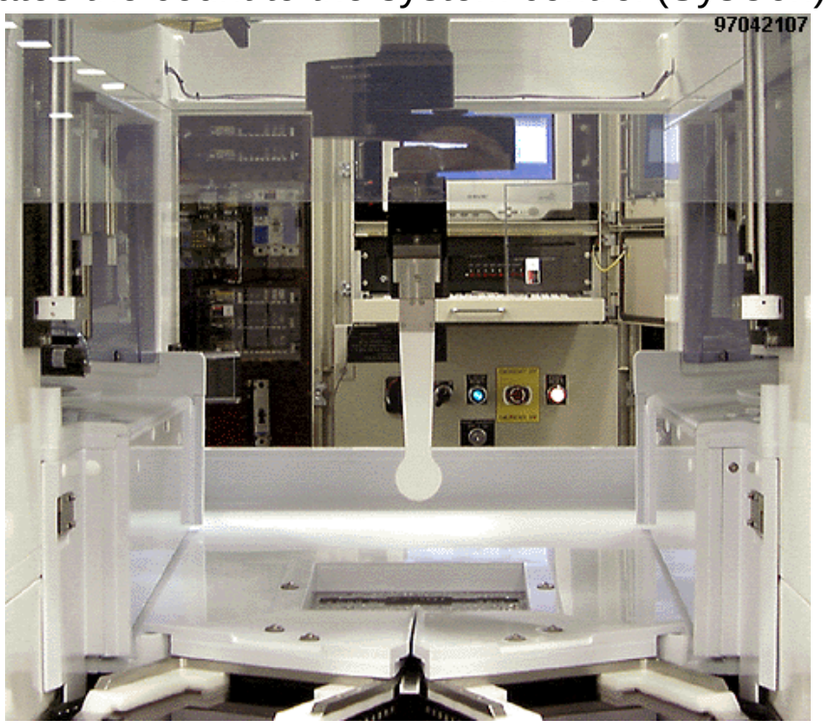


Figure 2-8. Cassette to Cassette (C2C) System

Wet Cassette Assembly

Introduction The wet cassette assembly, located in the lower middle section on the operator side of the Tool, is used for both prepolish and postpolish wafer storage.

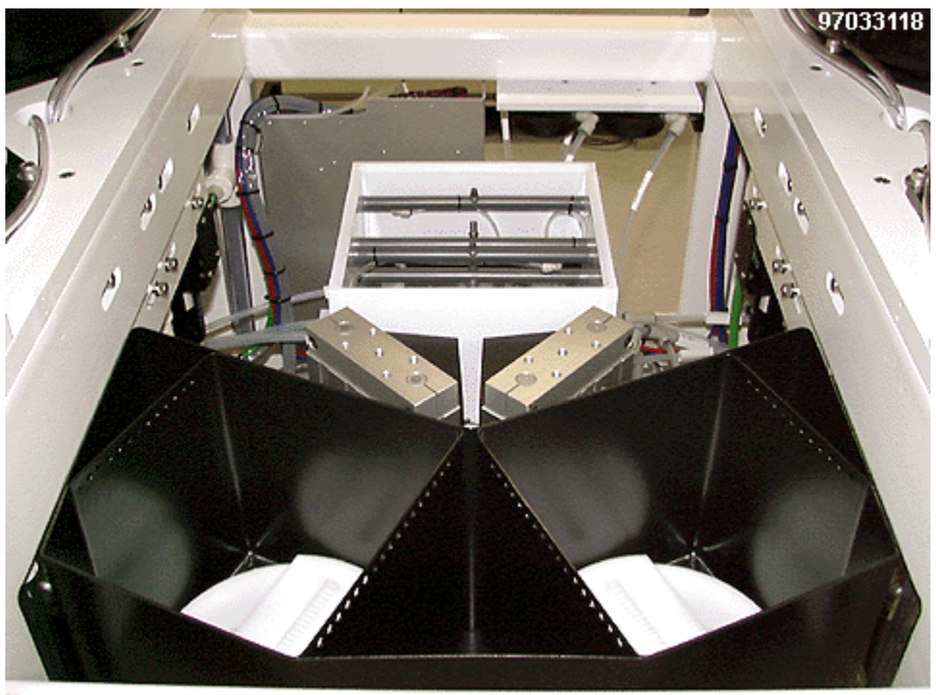


Figure 2-9. Wet Cassette Assembly

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Wet Cassette Assembly, continued

Function

The wet cassette assembly consists of the cassette basins, DI water manifolds, carrier lift towers, and two wafer cassettes. The cassette basin is a dual container that is filled with DI water and holds both wafer cassettes. At the bottom of each cassette compartment is the DI water manifold (DI manifold, wafer comb). Its purpose is to accurately seat the wafer cassette, correctly position each wafer, and supply an even flow of DI water in the wafer cassette. The carrier lift tower, located behind and connected through the cassette basin, lifts and rotates the carrier out of the storage basin to the operator access door so wafer cassettes can be loaded and unloaded. The carrier lift arms slide into channels on the sides of the wafer cassette. The wafer cassettes are removable and can hold 25 wafers.

Carrier Lift Tower

During a loading or unloading procedure, the carrier lift tower raises the wafer cassette out of the cassette basin, rotates the carrier with its cassette toward the operator, and the operator access door slides open. The operator can then unload the wafer cassette from the carrier, or load a new one.

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Wafer Sensor Array

Introduction The wafer sensor array uses a multi-bladed sensor to determine the number and position of wafers loaded into a wafer cassette. It is located on the operator side of the Tool on the upper frame directly above the wet cassette assembly.

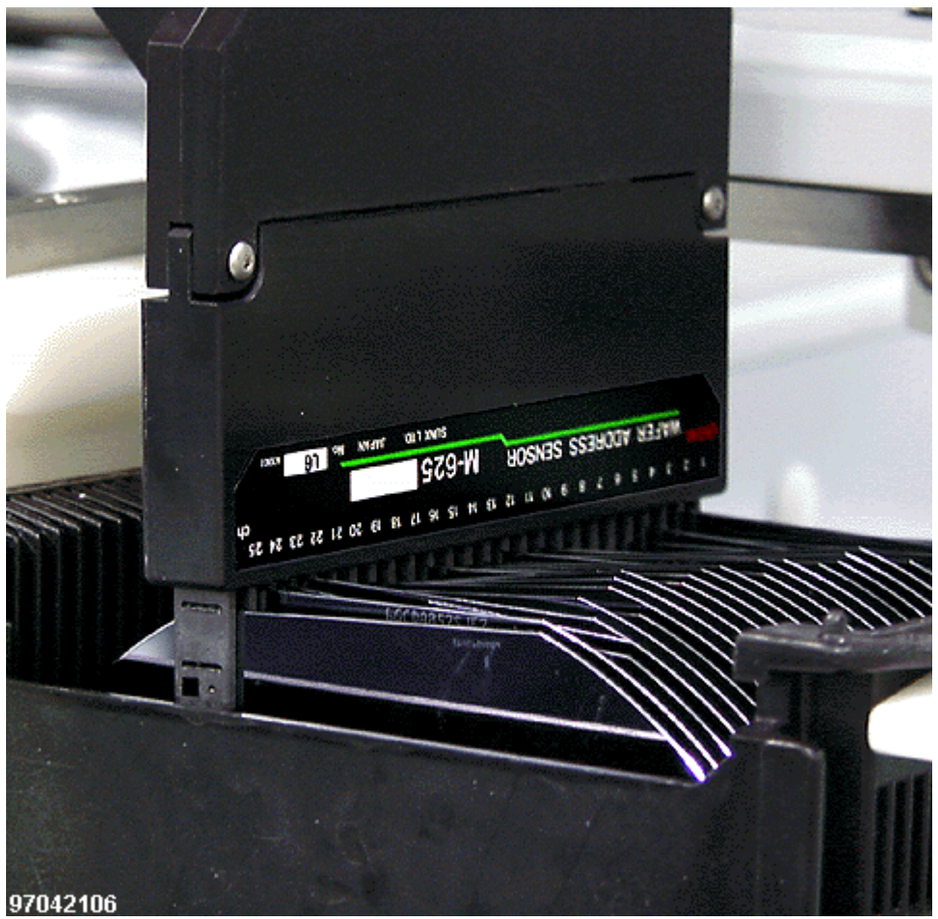

Figure 2-10. Wafer Sensor Array

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Wafer Sensor Array, continued

Description The array consists of two 25 slot wafer sensor heads attached to a flexible control cable. One array is located on each side of the vertical operator access frame. Each array senses the wafers in one side of the wet cassette assembly.
Refer to Figure 2-10 on page 2-25.

Function The wafer sensor array is activated automatically after the operator loads a wafer cassette into the carrier. When the “unload boats” command is sent, the wafer cassette is lifted out of the cassette basin. The carrier and its cassette are turned to the operator, and the operator access door is raised. After the operator loads a new wafer cassette into the carrier, and issues the “load boat” command, the wafer sensor head will automatically move down, placing its sensing channels between the wafers in the cassette. The sensor head then determines which slots are full, then sends this information to the SysCon computer so that accurate wafer identification and processing can occur. The wafer sensing head then raises back to its home position and the carrier turns and lowers the wafer cassette back to the processing position in the cassette basin.

C2C Pneumatic Panel Assemblies

Introduction There are two C2C pneumatic panel assemblies on the Tool, an upper and lower. (Be careful not to confuse the C2C panels with the MP Upper Pneumatic Panel Assembly and MP Lower Pneumatic Panel Assembly.)

Location The C2C upper pneumatic panel assembly is located in the middle of the upper frame on the chase side of the Tool. The C2C lower pneumatic panel assembly is also located on the chase side of the Tool, but is located in the lower middle section of the frame. Refer to Figure 2-12 on page 2-28 for the Closed Loop Delta P C2C Upper and Lower Pneumatic Panel Assemblies.

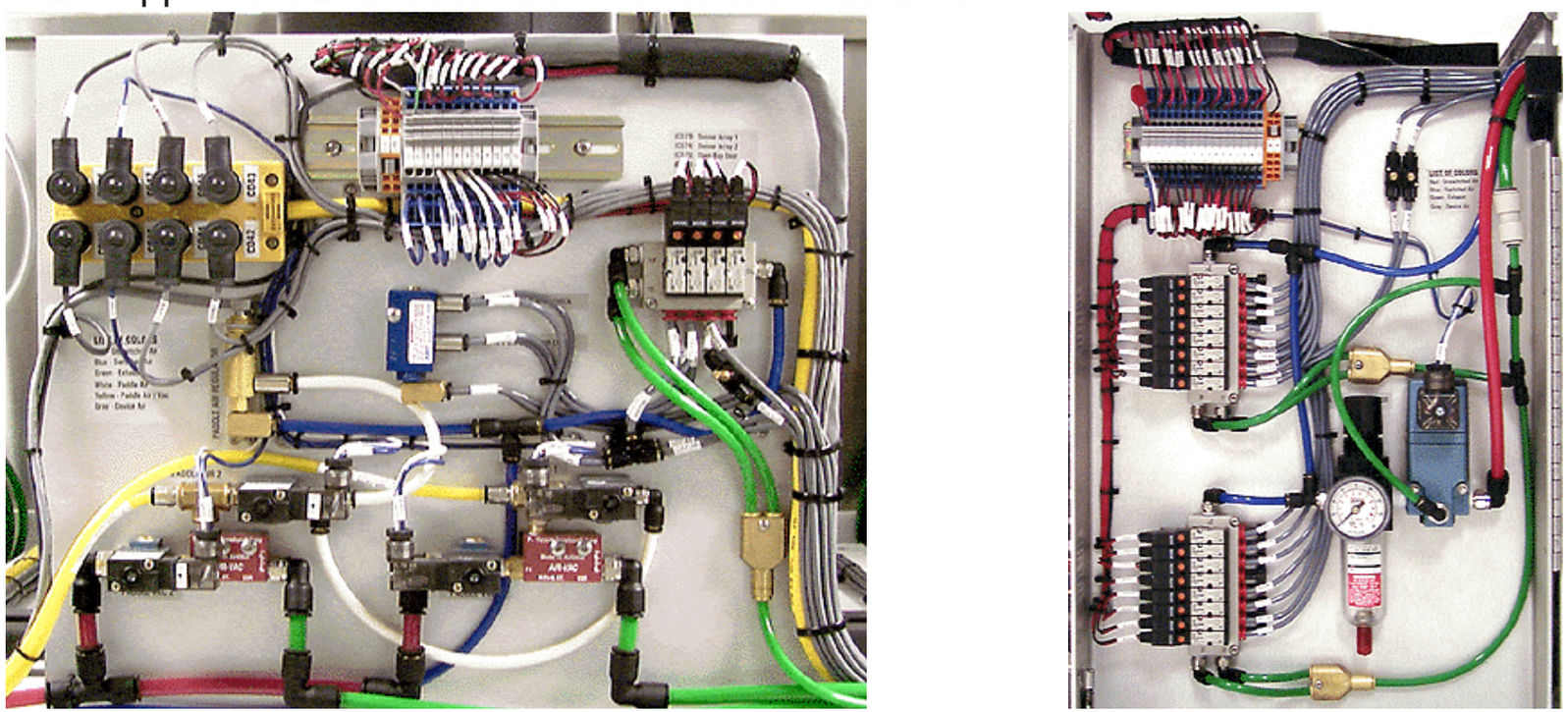

Figure 2-11. Typical C2C Upper and Lower Pneumatic Panel Assemblies

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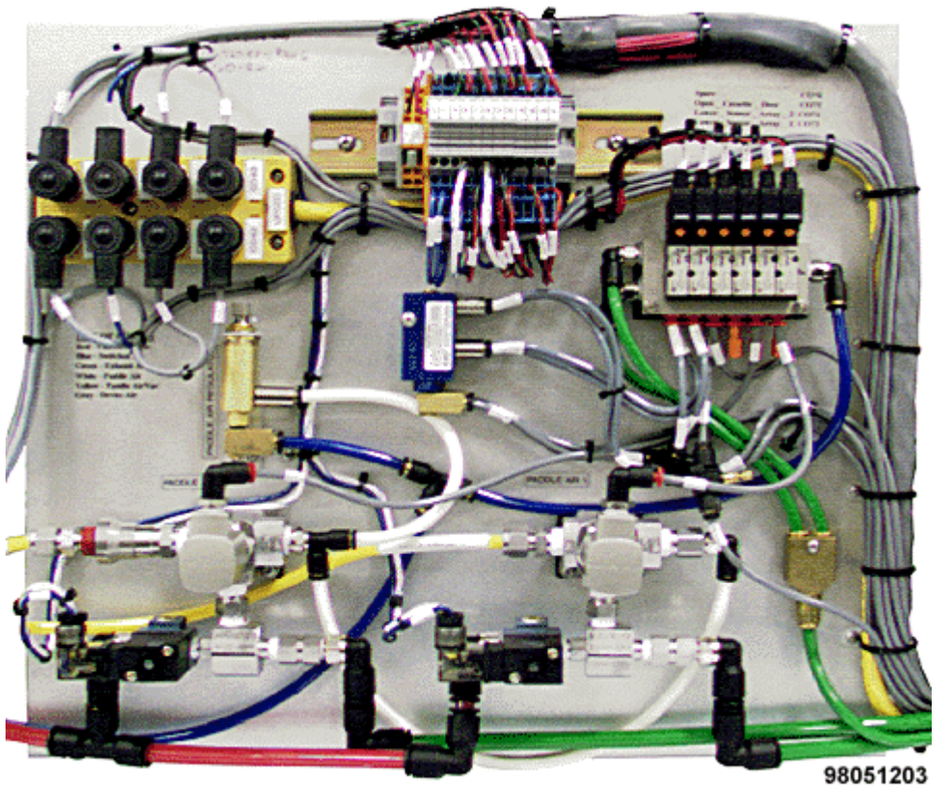
C2C Pneumatic Panel Assemblies, continued



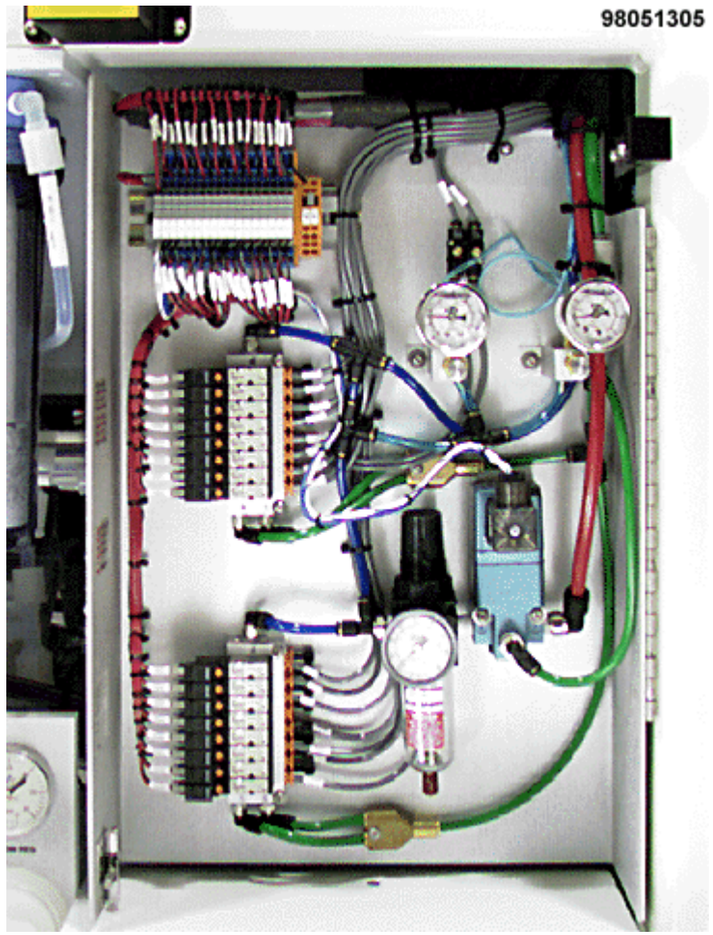


Figure 2-12. Closed Loop Delta P C2C Upper and Lower Pneumatic Panel Assemblies

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C2C Pneumatic Panel Assemblies, continued

Upper Panel Assembly Functions

Major functions of the C2C upper pneumatic panel assembly include:

- Air supply
- Vacuum generation

The upper panel assembly controls these functions for the wafer sensor array, the robot paddle, and for the operator load/unload door.

Lower Panel Assembly Functions

Major functions of the C2C lower pneumatic panel assembly:

- Air routing for lifting and turning the wafer cassette carrier lift towers
- Wet cassette DI water by-pass valve (Laminar flow)
- Valve module which controls slurry ON / OFF
- Slurry purge ON / OFF
- Pad conditioner rinse
- Spill sensor that detects spills during Tool operation

Spray Box Assembly

Introduction The spray box assembly is the process station used immediately after wafer polishing. It is located in the middle of the Tool, and is used as a rinsing station to remove slurry residue from the wafers.

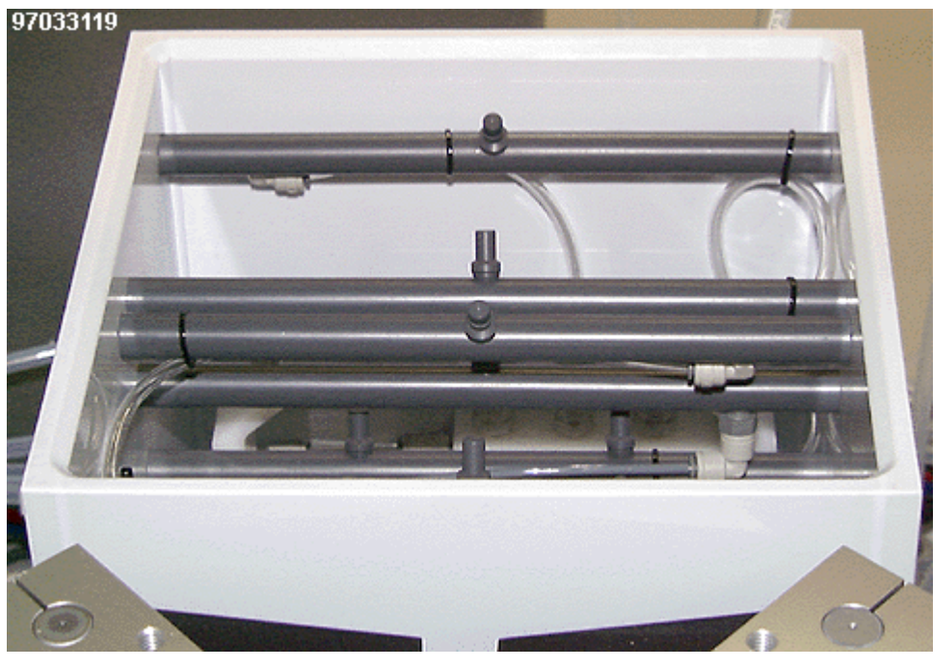

Figure 2-13. Spray Box Assembly

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Spray Box Assembly, continued

Description The spray box has two access ports and can hold and wet two wafers with DI water at the same time. Inside, there are two sets of bars with single jets angled to rinse the top half of the wafer and two sets of bars with double jets angled to rinse the bottom half of the wafer. There is also a single pneumatic jet to blow dry the wand. DI water supply and drainage lines supply and remove fluid from the spray box.

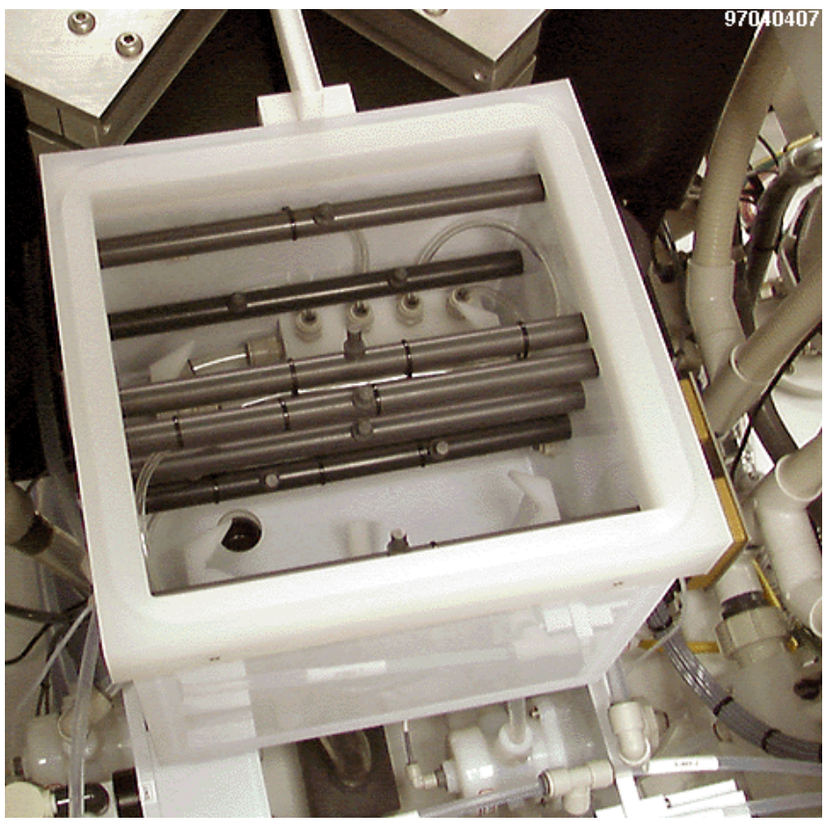
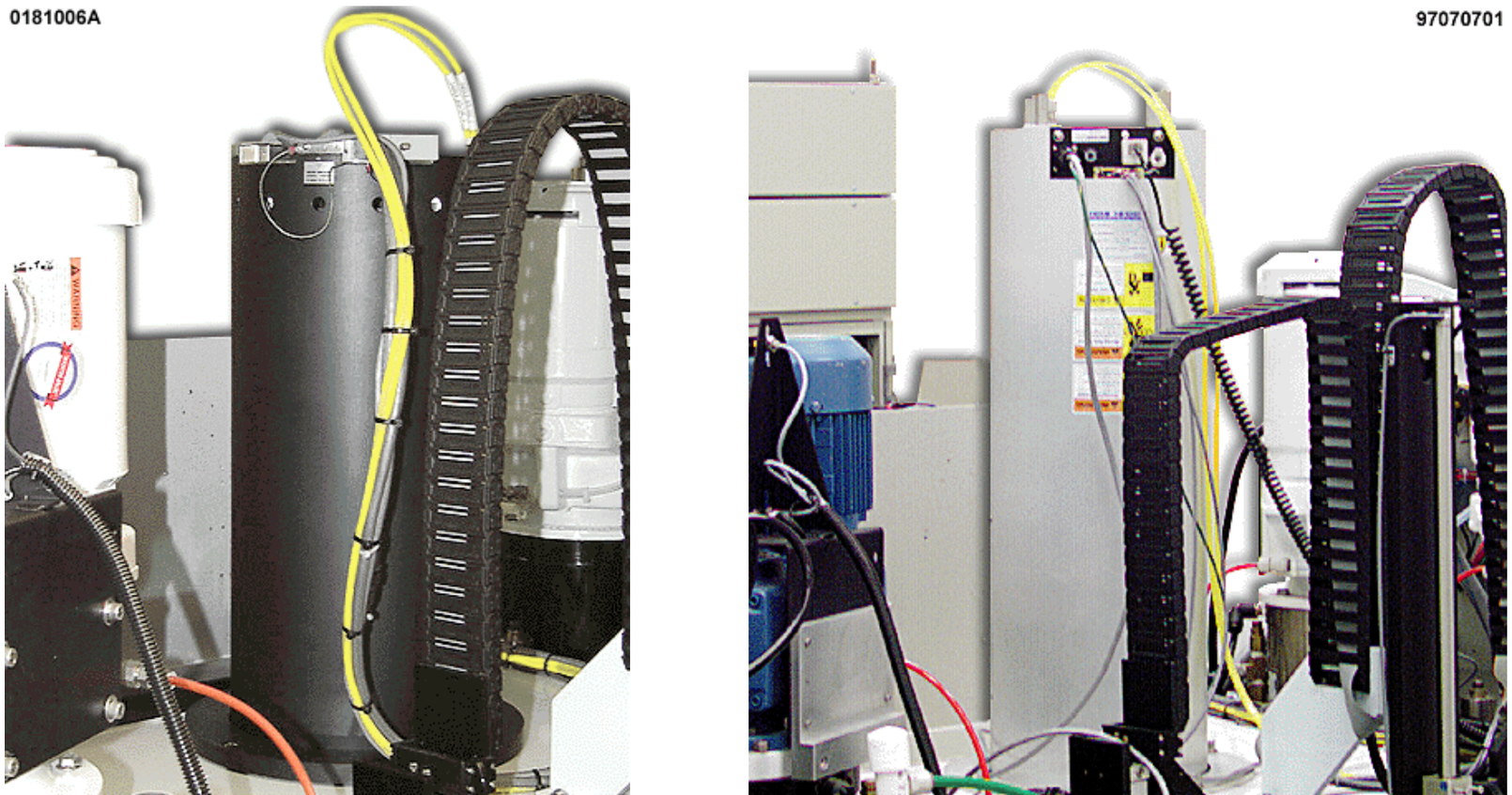


Figure 2-14. Spray Box Assembly Interior

Robot

Introduction The robot is located in the top center of the Tool and is responsible for moving the wafers in the Tool. The robot body extends above the top frame, and a jointed arm assembly extends directly below, between the head assemblies. The standard robot is a Genmark® Gencobot robot with customized wrist and wand attachments. The Hine® robot is available as a option.



Genmark® Robot

Hine® Robot

Figure 2-15. C2C Robot

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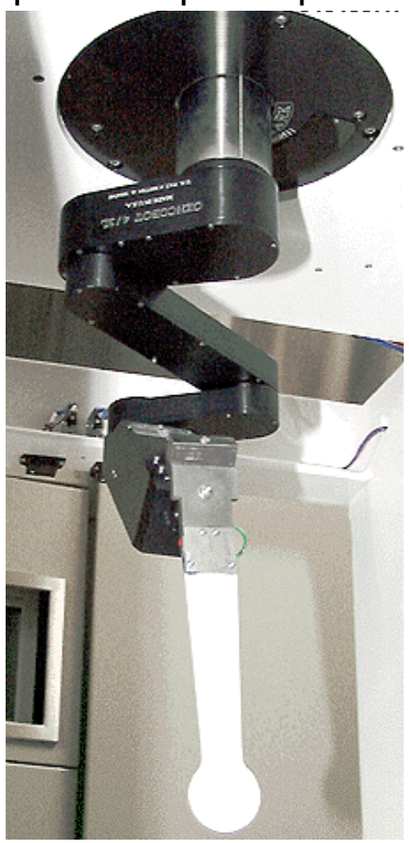
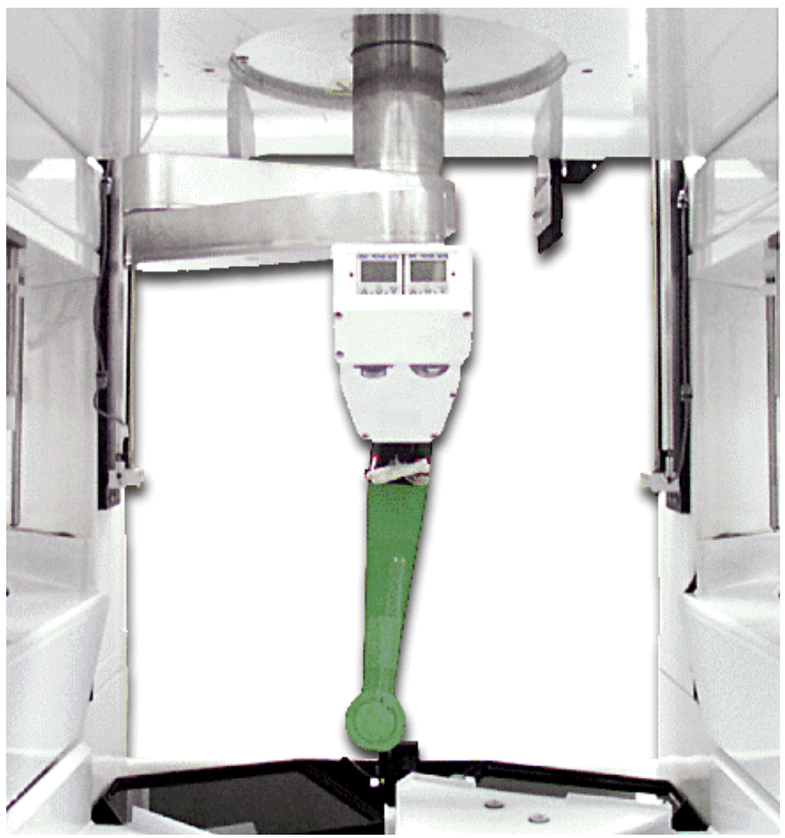
Robot, continued

Link Arm Custom Wrist and Arm

At the end of the robot arm is the wafer “end-effector” or wand. This wand is the contact surface for all wafer handling procedures. Using a combination of vacuum and air pressure, the wand picks up, holds, and delivers wafers to the various process stations in the Tool. Refer to Table 2-6 for the robot wafer handling steps in the polish process.



Gencobot® Link Arm



Optional Hine® Link Arm

Figure 2-16. Robot Link Arm and Wand

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Robot, continued

Robot Operations

Table 2-6. Robot Operations in a Typical Polish Cycle

Step	Instruction
1	Pick up a wafer from the wet cassette storage basin.
2	Position the wafer on the paddle using alignment pins.
3	Place the wafer in the wafer head for polishing.
4	Remove the wafer from the polish head when polish is complete.
5	Place the wafer into the spray box for rinsing.
6	Remove the wafer from the spray box when finished.
7	Replace the wafer in its original slot in the wet cassette storage basin.

Tool Points

Refer to CAP-24, “Setting Gencobot Robot Tool Points” on page 14-117 in the 676 Maintenance Manual, to check and set the Gencobot® robot Tool Points. Additional information is available in the Original Equipment Manufacturer (OEM) Manuals on the 676 CD-ROM in the Oem_manu.als\Genmark subdirectory.

Refer to CAP-25, “Setting Hine® Robot Tool Points” on page 14-150 in the 676 Maintenance Manual, to check and set the Hine® robot Tool Points. Additional information is available in the Original Equipment Manufacturer (OEM) Manuals on the 676 CD-ROM in the Oem_manu.als\Hine subdirectory.

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Robot, continued

Hine® Robot Specifications

The Hine® robot is engineered for use in a chemically severe CMP environment. The Hine® robot uses a servo controlled flipper wrist that can control wafers in either the vertical or horizontal orientation. The design uses 416 stainless steel for the Z-axis spindle and arm links, and PET material for the wrist housing and end effector. The entire electronics package is included in the base of the robot, so no external control chassis is required other than serial communication commands from the host computer. Refer to Table 2-7 for the Hine® robot specifications.

Table 2-7. Hine® Robot Specifications

Item	Description
Radial Extension	The robot has a total radial reach of 28 inches from center of robot to the end of the wrist housing, (12 inches in the negative direction.)
Z axis Extension	The robot has a maximum Z extension of 17 inches.
Theta Rotation	The robot is capable of a full 360° rotation.
Wrist Operation	The wrist operates with a servo controlled mechanism with an integrated fluid separator
Four Axis Controller	The entire electronic package and controller is located internally.
Pneumatics and Fittings	The vacuum lines are 1/8 inch ID and vacuum sense lines are 1/16 inch ID. All fittings are stainless steel, Teflon, nylon, or PET.
Software	The Hine® robot contains special custom macros to emulate the standard robot automation command subset used by the 676.
Power Requirements	24VDC, 12A max.
Compliance	The Hine® robot meets all CE and S2 requirements.

Robot, continued

Hine Safety Features

General Hine® robot safety information is contained in the Safety Information Chapter, Section 1.7, and other sections of the Hine® Design User's Manual, located in the Original Equipment Manufacturer (OEM) Manuals on the 676
CD-ROM in the Oem_manu.als\Hine subdirectory.

Hine Robot Z-Brake

The Hine® robot has a fail-safe brake on the Z axis motor. The brake will release only when power is applied to it. When robot power is OFF, the brake prevents any vertical movement. The Hine® robot has an external safety brake release connector which can be used to energize the brake and allow the Z axis to be moved manually. The connector is wired to an interface bracket located on the C2C Upper Pneumatic panel. Each 676 has an external 24VDC power supply. The Z axis brake safety release circuit and external 24VDC power supply are to be used in emergency situations only. Energizing the Z axis brake release connector when robot servos are disabled or robot power is OFF will deactivate the Z axis brake and cause the robot link arms to fall under their own weight.

Hine Teach Pendant

A teach pendant is supplied with the Hine® robot. The Teach pendant can be used for a number of tasks. Refer to Figure 2-17 on page 2-37. For more information on teaching the robot, refer to Chapter 3 of the Hine® Design User's Manual, located in the Original Equipment Manufacturer (OEM) Manuals on the 676 CD-ROM in the Oem_manu.als\Hine subdirectory.

Hine EMO Switch

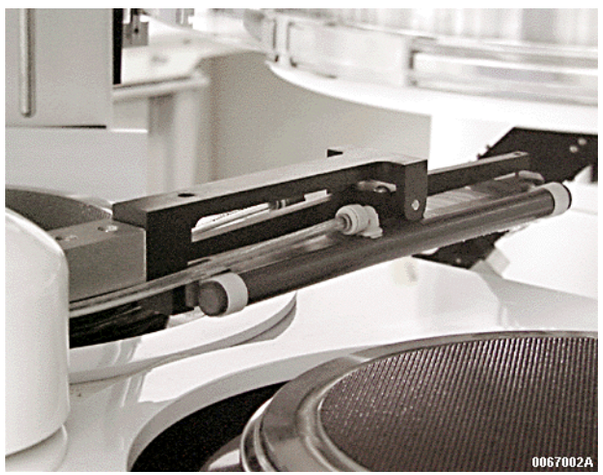
The teach pendant has an emergency stop motion button that can be used at any time to stop the motion of the robot. The button can be identified by the text "Emergency Stop" and is energized by a 24V power supply (supplied by SpeedFam-IPEC) to be used by the customer in emergency situations. Refer to Figure 2-17 on page 2-37.

Robot, continued

Figure 2-17. Hine® Robot Teach Pendant and EMO Switch

Pad Conditioning System

Location The pad conditioning system consists of the head assembly, servo motor, and arm assembly. The two pad conditioners are located between the front and rear polish heads on the sides of the Tool.



Pad Conditioner

Figure 2-18. Pad Conditioning System

continued on next page

Pad Conditioning System, continued

Purpose and Operation

The main function of the pad conditioners is to “rough up” or revitalize the pads after each polish cycle. They also rinse excess slurry and contaminants off the surface of the pads. Each conditioner system consists of a controller unit on a high voltage panel assembly in the Electrical Cabinet, a head assembly attached to the top of the motor, and an arm assembly that contains the pad effector and DI water lines. The controller unit directs the movement of each pad conditioner.

After a polish cycle, when the wafer has been removed from the polish pad, the pad conditioner arm moves over the polish head, lowers on to the polish pad, and begins a series of side to side sweeps. This action “roughs up” the pad and rinses the contaminants away. After conditioning, the arm raises and rotates back to its home position. To see the pad conditioner in motion, click on the movie in Figure 2-18.

Fluids System

Introduction The fluids system consists of a complex network of supply and drain plumbing lines for DI water, slurry mixtures, and scrub exhaust. Virtually all Tool systems are connected to the fluids system, which is interwoven throughout the frame.

DI water is supplied to the Tool from an external source. It is routed to the wet cassette assembly, the slurry module, the MP polish heads, and to the spray box assembly for various process uses.

The Slurry System supplies a slurry (polishing chemical) mixture to each polish head slurry module during the wafer polishing process.

When connected to an approved facilities vacuum source, two scrub exhaust systems remove fumes, exhaust air used by the pneumatic devices, and heat from the various Tool systems. The first system exhausts all pneumatic panel assembly devices and any slurry fumes from the MP heads. The second (base exhaust) system evacuates the entire lower frame area of particles and fumes.

Slurry System

Introduction The slurry system consists of the lines, filters, valves, and Slurry Modules, which supply slurry mixtures to each polish head. Slurry enters the system from the lower chase side of the Tool and flows through the slurry filters.

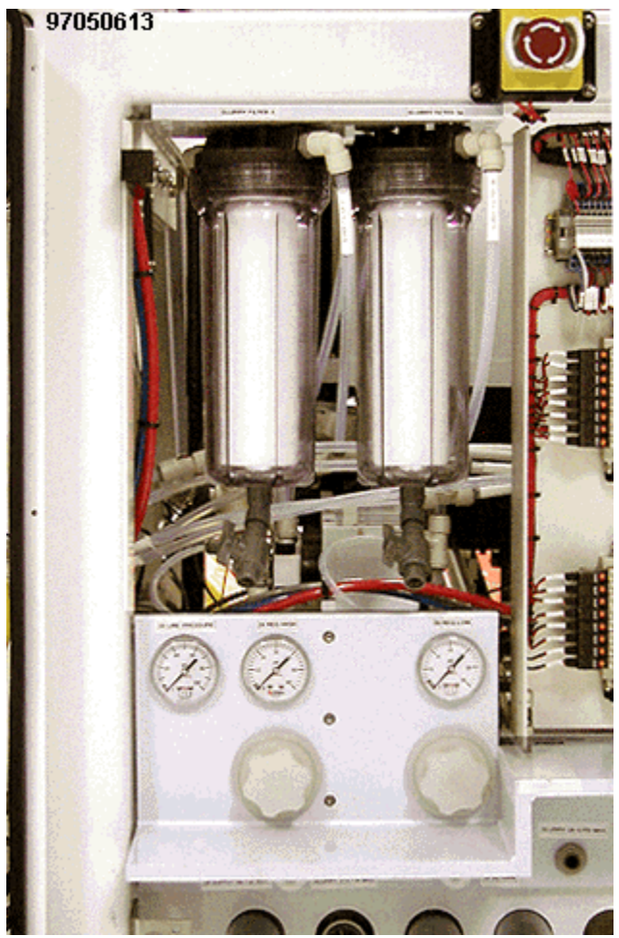


Figure 2-19. Slurry System Filters

Slurry Module

Purpose
Location

After the slurry is filtered, it is routed into each of the four slurry modules for distribution to the polish heads. A slurry module is located below each polish head on the sides of the Tool, and consists of several pumps and valves for mixing and delivering fluid.

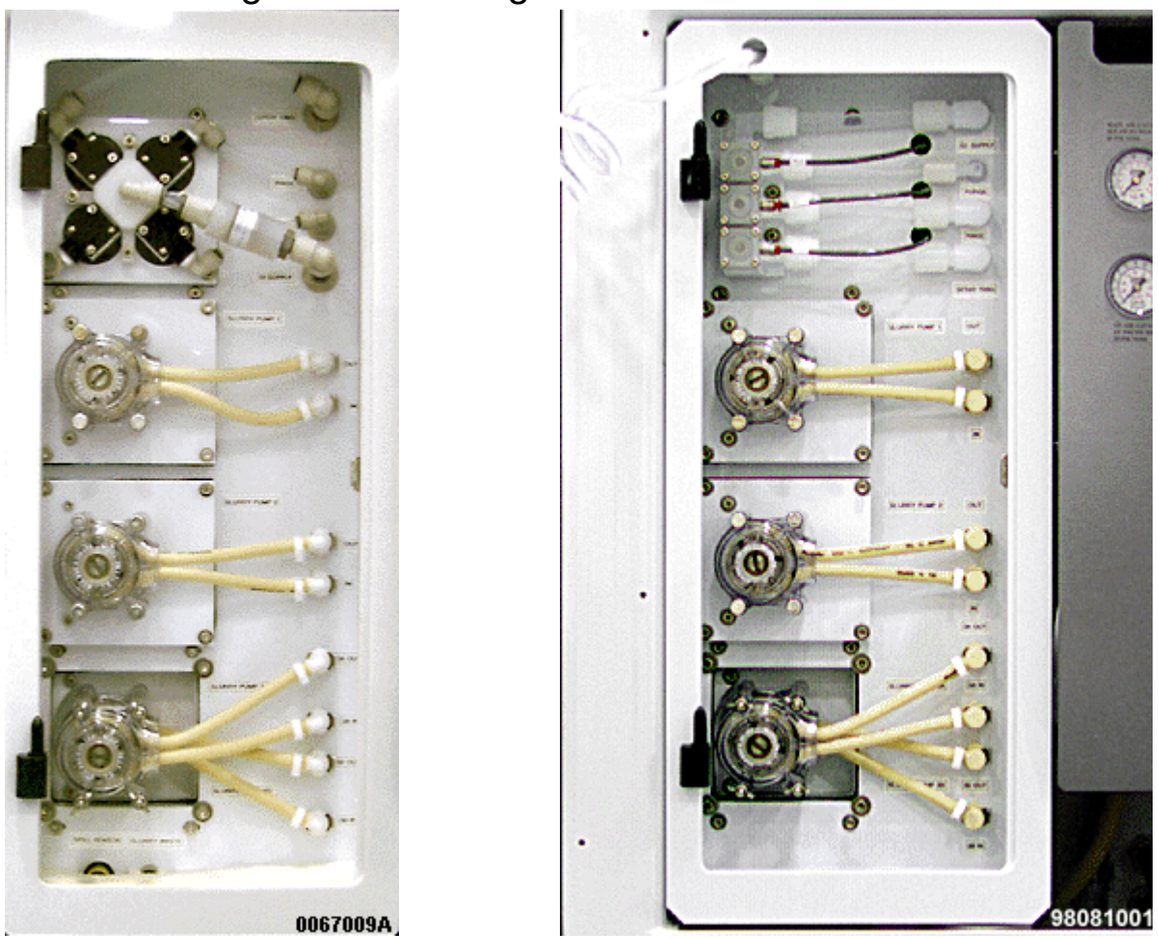


Figure 2-20. Typical Slurry Module and Slurry Module Upgrade

continued on next page

Slurry Module, continued

Operation

After polishing, non-pressurized drainage lines move “processed” fluids out of each component and into either waste or recycle lines for removal from the Tool. Software controlled diverter valves can use two separate recycle lines for later reclamation of slurry.

Features

The slurry modules can be configured to supply several different slurry mixtures to specific polish heads for custom processing. They also supply DI water for rinse and purge cycles, which clean supply lines after polishing.

Electrical Cabinet

Location The electrical and logic control systems for the Tool are located in the Electrical Cabinet.

Purpose Contains the computer and logic control systems for all the MP systems. Electrical Cabinet components and assemblies are used to connect, convert, and distribute electrical power to other Tool components.

continued on next page

Electrical Cabinet, continued

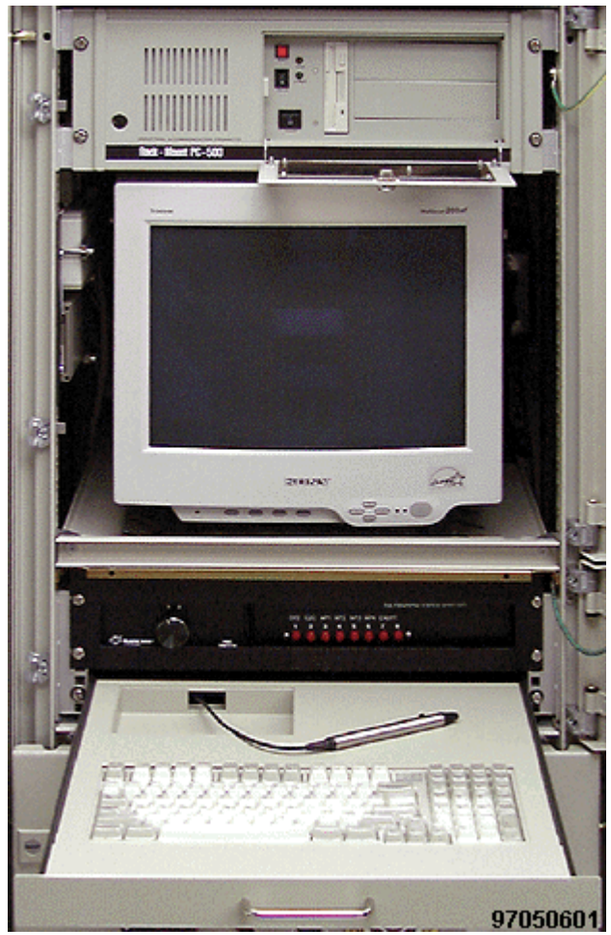


Figure 2-21. Electrical Cabinet Control Station

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Electrical Cabinet, continued

SysCon Computer

The System Control (SysCon) computer is an industrial microcomputer that manages all computer control functions. It is located near the top of the center section of the Electrical Cabinet.

Connected to all other system computers through a network, the SysCon is the “server” which contains system software, disk storage, disk drive, and user interface resources. All Tool operations controlled by the user are routed through the SysCon computer. The SysCon computer is programmed to delegate tasks to the other system computers, each with its own specialized functions.

Each of the Tool systems are controlled by independent processing units linked through a master SysCon computer to control the entire Tool. Logic control systems and the low voltage and high voltage electrical panel assemblies are located in the Electrical Cabinet. The Electrical Cabinet is typically located on the chase (back) side of the Tool. Sub-floor electrical, pneumatic, and plumbing lines connect the Main Tool, Electrical Cabinet, and facility resources.

Control Station

A control station, used primarily for diagnostic or maintenance work, is located directly below the SysCon computer in the middle section of the Electrical Cabinet. It consists of a monitor, keyboard, light-pen, and a switch box for monitoring the displays of the other system computers.

The Electrical Cabinet control station, like the primary operator control station on the front side of the Tool, can be used to operate the Tool. However, it is not the primary station for Tool operation. Because it gives direct access to the SysCon computer, as well as keyboard control and a switch box for monitoring the displays of all other system computers, this station is used primarily for system diagnostics, certain maintenance procedures, and by the manufacturer for programming access.

continued on next page

Electrical Cabinet, continued

ServSwitch The ServSwitch system replaces the standard keyboard / video switch box and allows the operator to use one mouse to control all six stations while in Service Mode. The standard configuration keyboard / video switch box requires maintenance personnel to use a separate mouse for each station (MP1, MP2, etc.).

continued on next page

Electrical Cabinet, continued

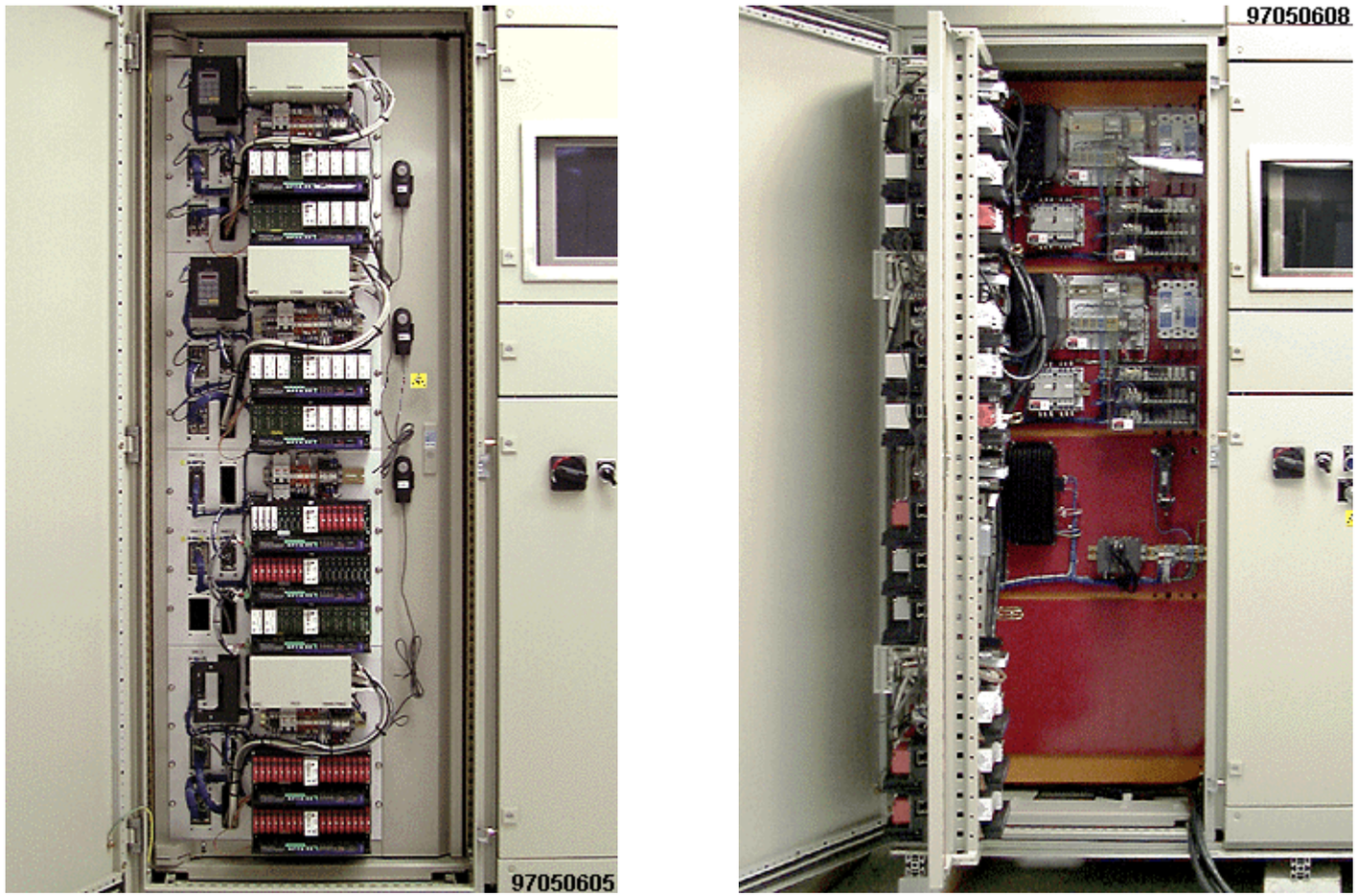


Figure 2-22. Typical Electrical Cabinet Low Voltage Swing Panel

continued on next page

Electrical Cabinet, continued

MP LV Swing Panels

The low voltage swing panels contain the logic control hardware for each MP module. This control includes:

- Air and vacuum pressures.
- Polish pressures.
- Spindle speeds for the upper and lower head assemblies.

The MP low voltage panel assemblies contain an MP computer, local stop relay, spindle enable relay, and five racks of I/O.

The MP computers, located on the low voltage panel assemblies, are networked to the SysCon computer. These computers control the wafer and polish head processes for each MP. High voltage panel assembly components control wafer and polish head motor revolution speed as well as pump speeds in each slurry module. These panel assemblies contain a variable-frequency drive, three DC motor controllers, a slurry enable relay, a three-pole contactor, and two three-pole AC motor overload protectors.

Pad Conditioner Panel Assemblies

Pad conditioner low voltage panel assemblies supply the input and output signals needed to control and receive feedback from the pad conditioners. The panel assemblies contain a local stop relay and three racks of I/O. The C2C computer, which is located on the C2C low voltage panel assembly, controls the I/O on this rack.

The pad conditioner high voltage panel assemblies contain the controllers for each pad conditioner system. There are two pad conditioner high voltage panel assemblies on the Tool.

continued on next page

Electrical Cabinet, continued

C2C Panel Assemblies

The C2C low voltage panel assembly contains the C2C computer, a local stop relay, the sensor array relay, and five racks of I/O. There is one C2C low voltage panel assembly on the Tool.

The C2C computer is networked to the SysCon computer. It is mounted on the C2C panel assembly on the left hand side of the Electrical Cabinet. The C2C computer directs the actions of all C2C systems as well as the non-polish process stations.

Control signals are routed through the C2C panel assembly to cause the movement of each component. These processes are coordinated with all other system functions by the SysCon computer.

The robot controller is located on the C2C high voltage panel assembly. Its single function is to supply logic control for the robot system through a 25 ft. (7,6 M) cable that connects the robot to the controller. There is one C2C high voltage panel assembly on the Tool.

Main Power Panel Assembly

The main power panel assembly contains the AC and DC power conversion and distribution components, which supply electrical power to all Tool systems. The main power panel assembly is located in the lower-center section of the Electrical Cabinet. Panel assembly components include a three-pole main circuit breaker, an EMO contactor, a parallel transient voltage surge suppressor, an isolation transformer, and 24V, 12V, -12v, and 5V power supplies.

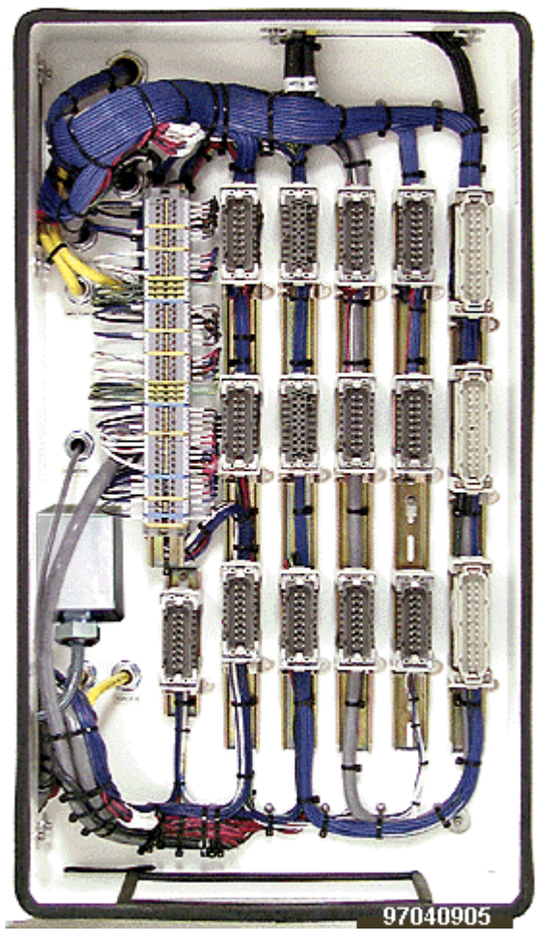
continued on next page

Electrical Cabinet, continued

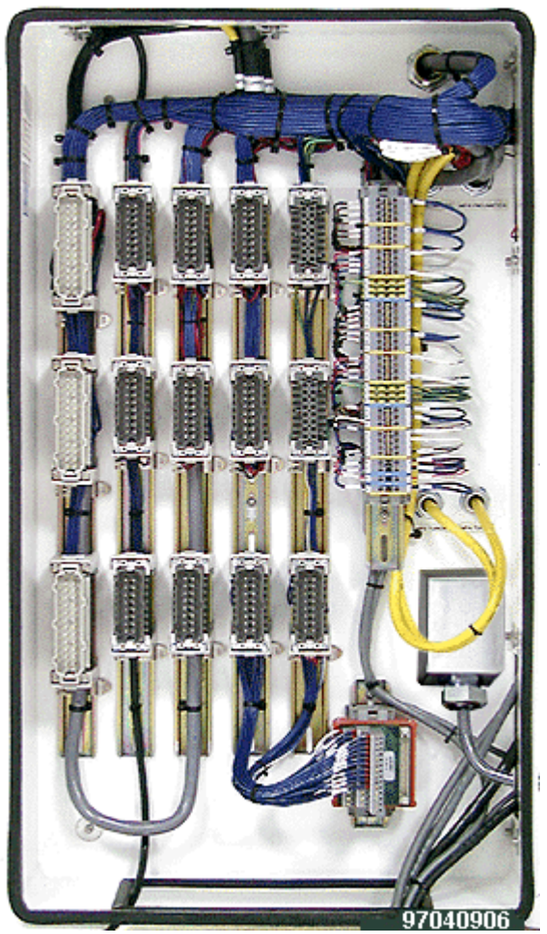
Interconnect Boxes

Although they are located on the Main Tool, the interconnect boxes are included with the Electrical Cabinet power distribution assemblies. The two interconnect boxes are located on the lower chase side of the Main Tool. The interconnect boxes are used to connect the Electrical Cabinet components to the electrical components on the Main Tool. Power distribution and I/O connection lines are routed from the Electrical Cabinet into the Tool through the interconnect boxes. The interconnect box on the right contains the connections to MP 1 and 2, pad conditioner 1, and the spray box and wet cassette. The interconnect box on the left contains the connections to MP 3 and 4, pad conditioner 2, the robot, and the wafer sensor arrays. Refer to Figure 2-23 on page 2-52.

Electrical Cabinet, continued



Left Side



Right Side

Figure 2-23. Interconnect Boxes

Endpoint Detection Systems

Three Options

Three optional endpoint detection systems are available on the 676: Brookside®, Luxtron, and the Filmetrics F76®.

Brookside®

The Brookside® Endpoint (EP) detection system for Tungsten (W) polish uses a dedicated computer to monitor relative friction during the polishing process. The relative friction of the pad moving across a W surface in the presence of slurry is lower than that for a TiN surface. By monitoring motor current, a change in relative friction detects the W endpoint. Optional endpoint detection systems are available for Oxide polishing. For additional information, refer to the Original Equipment Manufacturer (OEM) Manuals on the 676 CD-ROM in the Oem_manu.als\Brookside subdirectory.

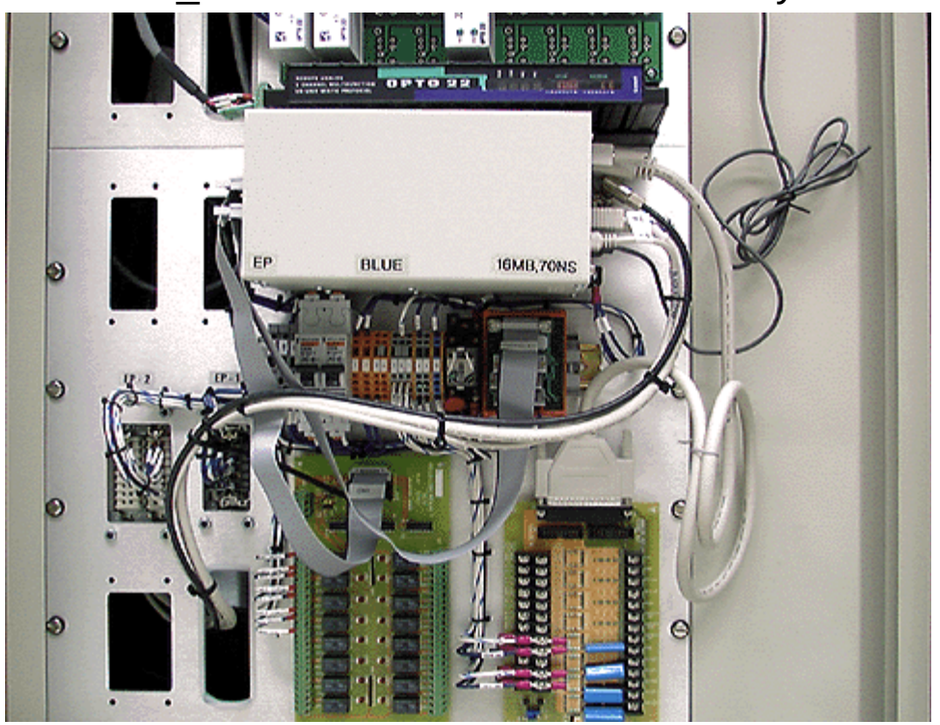


Figure 2-24. Brookside End Point Computer Panel Assembly

Endpoint Detection Systems, continued

Luxtron

The Luxtron End Point (EP) detection system stops the polishing process by detecting complete removal of the current process layer. The system uses a dedicated computer to monitor relative friction during the polishing process. The relative friction of the pad moving across an X surface in the presence of slurry is lower than that for a Y surface. By monitoring motor current, a change in relative friction detects the X endpoint. The system is located in the Electrical Cabinet. See “Luxtron Endpoint Detection System” on page 6-27. in the 676 Maintenance Manual, for more information.

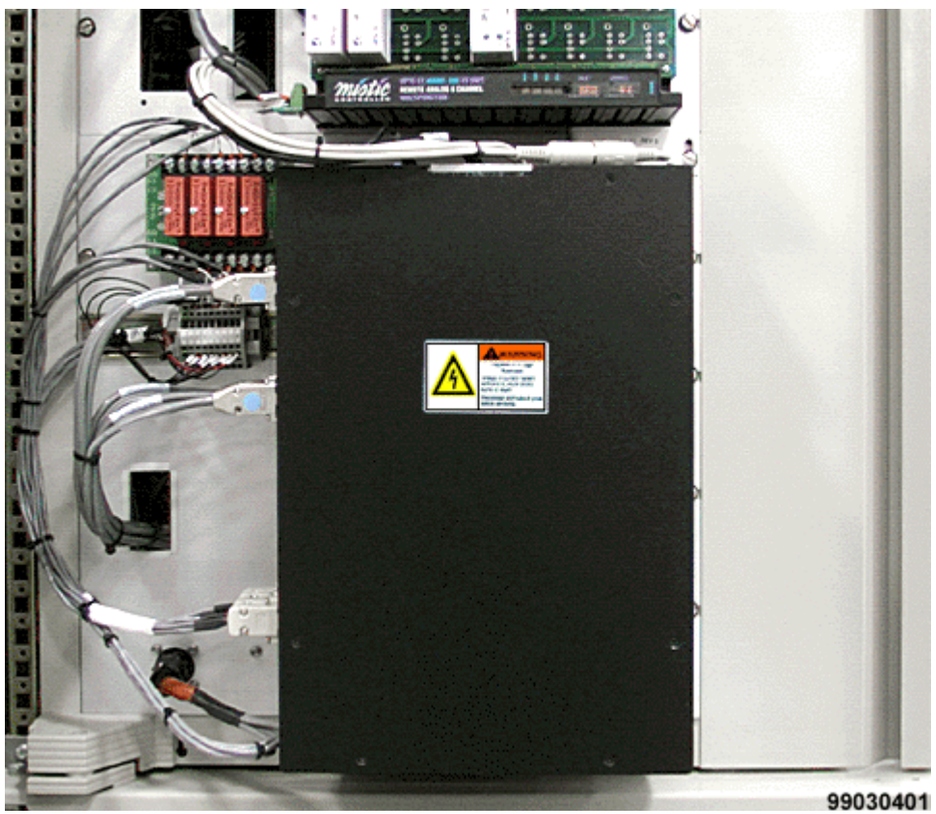


Figure 2-25. Luxtron Endpoint 9325 RTC Computer Assembly

Endpoint Detection Systems, continued

F76®

The optional Endpoint Detection System Filmetrics® (F76) Endpoint Detection system is an optical endpoint system for chemical mechanical polishing (CMP) applications. The F76 Endpoint (EP) detection system stops the polishing process by detecting complete removal of the current process layer using spectral analysis of reflections from the surface of the polished wafer. The F76 measures the reflection spectrum from the surface of the wafer as it is being polished. The software analyses successive reflection spectra to determine the process endpoint. Each polish head is monitored independently so the F76 system can control all four polishing heads at the same time. See “F76 Endpoint Detection System” on page 6-30. in the 676 Maintenance Manual, for more information.

Process Application

The primary process application of the F76 system is Tungsten (W). Future applications, which may become available through software and hardware upgrades, include copper and oxide polishing.

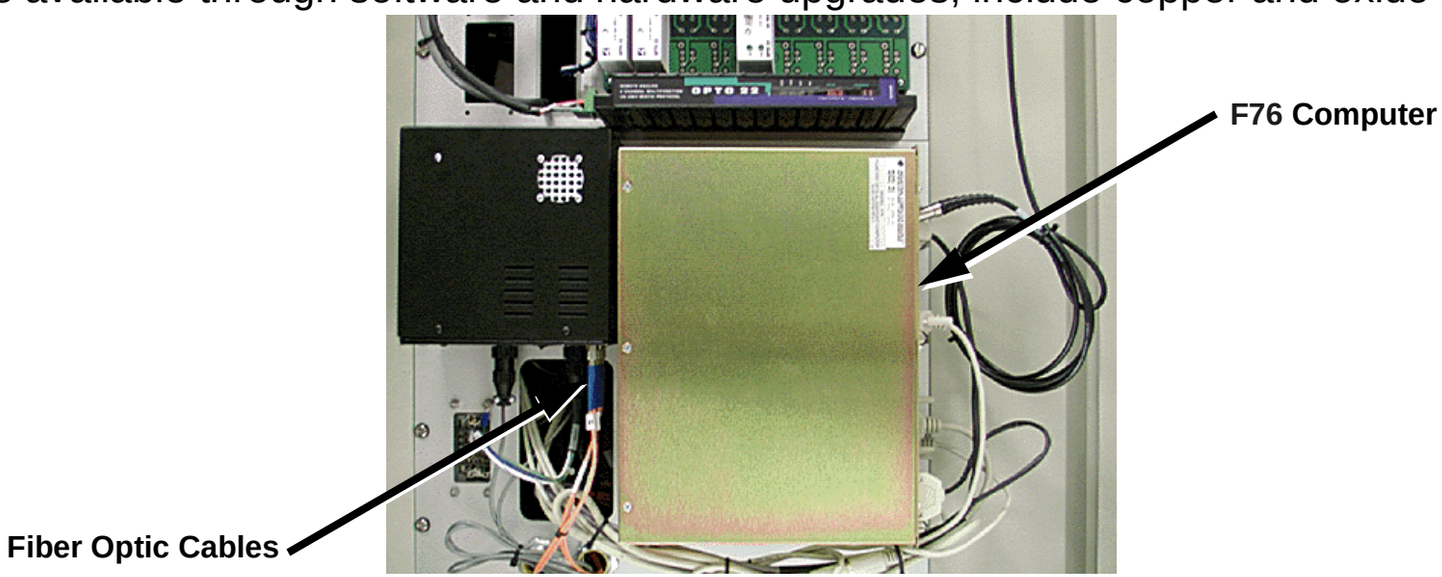


Figure 2-26. F76 Endpoint Computer Panel and Fiber Optics Cables

Notes:

Chapter 3

Safety Hazards and Precautions

Contents This chapter contains the following topics:

Topic	See Page
Overview	3-2
Consequences of Safety Violations	3-5
Danger, Warning, Caution, and Note Icons	3-6
Emergency OFF (EMO) Circuit	3-15
System Interlocks	3-21
Alarm Messages	3-26
Mechanical Hazards	3-29
Electrical Hazards	3-44
Chemical Hazards	3-73
Material Safety Data Sheets	3-83
Cleaning and Spills	3-85
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General Hazards	3-90
Laser Hazards	3-92
S2-93 and CE Compliance	3-93
Moving the Tool	3-94

Overview

Introduction

The safety of the AvantGaard™ 676 operator is extremely important to SpeedFam-IPEC. The Tool was designed to minimize operator exposure, but hazards are inherent with any complex machinery. In this chapter, potential safety hazards are identified and discussed. Recommendations for the safe use of this equipment are given here as well as in the troubleshooting and maintenance chapters. **Please read this chapter thoroughly.**

Functional Safety Hazards

The AvantGaard™ 676 is a highly automated, electro-pneumatic, mechanical wafer polisher that is designed with many safety features. All electromechanical machinery have various safety precautions that must be observed by the operator to make sure the polisher is operated safely.

Functional safety hazards are those present during normal operation of the Tool. These safety hazards are present due to the electrical, mechanical, chemical, and thermal operating characteristics of the Tool. These specific safety hazards and associated precautions are detailed in the following sections.

General Operational Safety Hazards

Other safety hazards may be present, including safety hazards due to sharp objects, broken wafers, or pinch points. These general operational safety hazards require safety precautions that must be observed by the operator at all times.

Lockout Feature

The Tool is equipped with a lockout feature on the main disconnect switch on the Electrical Cabinet. The lockout feature is a lockout tab in the center of the switch. The tab is used to padlock the switch in the OFF position. Use the lockout feature of the main disconnect switch when Tool electrical power is OFF. Locking out the handle will make sure power cannot be applied, and increases personal safety until the lockout is removed.

continued on next page

Overview, continued

Tool Status

Proper personnel notification procedures should be used to identify Tool status. Facility tagout procedures should be used to give personnel rapid status identification of the Tool. Tagout procedures consist of status tags positioned in a suitable location for rapid status recognition. They give an added measure of safety.

S2-93 / IEC Compliance

The Tool described in this manual is S2-93 and IEC compliant. S2-93 safety guidelines are intended as a minimum set of performance based environmental, health and safety considerations for equipment used in semiconductor manufacturing. These guidelines are produced by SEMI, a semiconductor manufacturer consortium that sets safety standards, similar to UL listings for consumer electronics.

[S/N 3031] This Tool was originally built with white colored neutral power wires in some locations. To comply with applicable CE regulations, these locations now have light blue heat shrink tubing, with a "NEU" label, to endmark the white neutral power wires. This Tool was originally built with solid green colored earth ground wires in some locations. To comply with applicable CE regulations, these locations now have GRN/YEL bicolor heat shrink tubing to endmark the green earth ground wires.

continued on next page

Overview, continued

Personal Protective Equipment (PPE)

The Tool is designed to be used in a Class 1 cleanroom environment. Under normal conditions, Tool operators and maintenance personnel do not require additional protective clothing or equipment other than that which is prescribed for working in the specified cleanroom environment.

Typical Class 1 cleanroom clothing requirements include a full body suit, which covers all parts of the body including the feet and head. Requirements also specify that gloves and protective glasses be worn at all times. Operators should follow all operation and maintenance specifications indicated on site.

Site Specific Safety Check

After the Main Tool and Electrical Cabinet have been properly installed, and all facilities and electrical connections have been made, site specific safety criteria should be checked before allowing personnel to work with the Tool.

EHS Analysis

SpeedFam-IPEC is committed to the highest level of safety for all personnel. The AvantGaard™ 676 has been subjected to a comprehensive Environmental Health and Safety (EHS) analysis. This analysis was completed to identify and eliminate hazards to personnel installing, operating, or maintaining the equipment.

Site Specific Safety Check

After the Main Tool and Electrical Cabinet have been properly installed, and all facilities and electrical connections have been made, site specific safety criteria should be checked before allowing personnel to work with the Tool.

Consequences of Safety Violations

Introduction Safety guidelines and procedures exist for the protection of all personnel associated with the operation or maintenance of the AvantGaard™ 676. The mechanical, electrical, and chemical hazards associated with this Tool have significant destructive potential.

Personal Injury Personal injury is the most important safety concern. The potential for serious and even life-threatening injury exists if safety mechanisms and procedures are ignored or purposely overridden. Under no circumstances should an operator disable safety circuits, interlock mechanisms, or safety shields.

Product Damage Product damage can result from modified, unsafe, or careless Tool operation. Wafers represent an enormous investment of time, technological resources, and money. Operating the Tool in an unsafe condition or in an unauthorized manner can damage or destroy wafers.

Tool Damage Damage to sensitive Tool components and assemblies, including the robot arm, wafer sensors, operator access doors, and other systems can happen during modified, unsafe, or operating and maintenance procedures that are not approved.

Facility Damage Facility electrical disruption, fluid discharge, or system contamination could result from failure to follow specified maintenance and operational procedures.

Training Because safety of the AvantGaard™ 676 Operator and Maintenance personnel is extremely important to SpeedFam-IPEC, formal training offered by SpeedFam-IPEC is essential to maintain a high level of safety. Please contact the SpeedFam-IPEC Training Department at (480) 785-4473 to arrange training for any personnel operating the AvantGaard™ 676.

Danger, Warning, Caution, and Note Icons

Definitions

To emphasize and to make clear the importance of Danger, Warnings, Cautions, and Note icons in the manual and on the AvantGaard™ 676, the definitions and formats shown on the following pages are used. If you do not pay attention to them, and the safety information they contain, you can be injured, lose your life, or damage the product or the Tool.

In the AvantGaard™ 676 manuals, all Dangers, Warnings, and Cautions are located directly above the text to which they apply, and Notes are located directly below the text to which they apply. Refer to page 3-7 for descriptions.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

DANGER - THESE SYMBOLS ARE USED IN THE MANUAL, AND ON LABELS IN THE TOOL, TO ALERT THE USER TO THE PRESENCE OF DANGEROUS VOLTAGE, WITHOUT INSULATION, IN THE MACHINE'S ENCLOSURE(S). PERSONAL INJURY OR LOSS OF LIFE WILL RESULT IF PROPER OPERATING PROCEDURES, PRACTICES, ETC. ARE NOT CORRECTLY FOLLOWED.

DANGER - CES SYMBOLES SONT UTILISÉS DANS LE MANUEL ET SUR LES ÉTIQUETTES DE LA MACHINE, POUR METTRE L'UTILISATEUR EN GARDE CONTRE LA PRÉSENCE DE VOLTAGE DANGEREUX, SANS ISOLANT, À L'INTÉRIEUR DES ENCEINTES DE LA MACHINE. SI VOUS NE SUIVEZ PAS CORRECTEMENT LES PROCÉDURES ET LES MÉTHODES D'UTILISATION, VOUS RISQUEZ DES BLESSURES OU LA MORT.

GEFAHR - DIESE IM HANDBUCH UND AUF DEN WERKZEUGSCHILDERN VERWENDETEN SYMBOLE WEISEN DEN BENUTZER DARAUF HIN, DAß IM GEHÄUSE BZW. IN DEN GEHÄUSEN DER MASCHINE EINE GEFÄHRLICHE, NICHT ISOLIERTE SPANNUNG VORLIEGT. EINE NICHTBEFOLGUNG DER ORDNUNGSGEMÄßEN BEDIENUNGSVORSCHRIFTEN, -VERFAHREN, USW. KANN KÖRPERVERLETZUNGEN ODER DEN TOD VERURSACHEN.

ОПАСНОСТЬ - Эти символы используются в Руководстве и на табличках в установке для того, чтобы предупредить пользователя о наличии опасного напряжения на неизолированных элементах внутри кожухов установки. Если не применять надлежащие режимы и методы работы, это может привести к травмам или несчастным случаям со смертельным исходом.

Danger, Warning, Caution, and Note Icons, continued

WARNING - THESE SYMBOLS ARE USED IN THE MANUAL, AND ON LABELS IN THE TOOL, TO ALERT THE USER TO THE PRESENCE OF PINCHING AND CRUSHING HAZARDS. PERSONAL INJURY OR LOSS OF LIFE CAN RESULT IF PROPER OPERATING PROCEDURES, PRACTICES, ETC. ARE NOT CORRECTLY FOLLOWED.

AVERTISSEMENT - CES SYMBOLES SONT UTILISÉS DANS LE MANUEL ET SUR LES ÉTIQUETTES DE LA MACHINE, POUR METTRE L'UTILISATEUR EN GARDE CONTRE DES RISQUES DE BROYAGE ET DE PINÇAGE. TOUTE INFRACTION AUX PROCÉDURES, PRATIQUES, USW. DE FONCTIONNEMENT PEUVENT OCCASIONNER DES BLESSURES OU LA MORT.

WARNING - DIESE IM HANDBUCH UND AUF DEN WERKZEUGSCHILDERN VERWENDETEN SYMBOLE WEISEN DEN BENUTZER DARAUF HIN, DAß EINE EINKLEMM- UND QUETSCHGEFAHR BESTEHT. EINE NICHTBEFOLGUNG DER ORDNUNGSGEMÄßEN BEDIENUNGSVORSCHRIFTEN, -VERFAHREN, USW. KANN KÖRPERVERLETZUNGEN ODER DEN TOD VERURSACHEN.

ПрЕДУПрЕЖДЕНИЕ - Эти символы используются в Руководстве и на табличках в установке для того, чтобы предупредить пользователя о существовании опасности защемления и раздавливания. Если не применять надлежащие режимы и методы работы, это может привести к травмам или несчастным случаям со смертельным исходом.

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Danger, Warning, Caution, and Note Icons, continued

CAUTION - This symbol is used in the manual, and on labels in the Tool, to alert the user to the presence of important operation and maintenance information, which, if not strictly observed, can result in damage to, or destruction of, equipment.

ATTENTION - Ce symbole est utilisés dans le manuel et sur des étiquettes de la machine, pour avertir l'utilisateur de la présence d'instructions importantes de fonctionnement et d'entretien qui, si elles ne sont pas suivies, peuvent occasionner des dommages au matériel, ou sa destruction.

VORSICHT - Dieses im Handbuch und auf den Werkzeugschildern verwendete Symbol weisen den Benutzer darauf hin, daß wichtige Betriebs- und Wartungsvorschriften vorliegen, die streng eingehalten werden müssen, um eine Beschädigung bzw. Zerstörung des Geräts zu vermeiden.

ПрЕДОСТЕрЕЖЕНИЕ - Этот символ используется в Руководстве и на табличках в установке для того, чтобы предупредить пользователя о существовании важных указаний по эксплуатации и техническому обслуживанию, несоблюдение которых может привести к повреждению или разрушению оборудования.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

CAUTION - This symbol is used in the manual, and on the Tool, to alert the user to the presence of chemical risk or hazard of an operating procedure or practice, which, if not correctly followed, can result in personal injury or bodily damage to personnel.

ATTENTION - Ce symbole est utilisés dans le manuel et sur la machine, pour mettre l'utilisateur en garde contre un risque ou un danger chimique lors d'une procédure ou une pratique de fonctionnement, qui, si elle n'est pas suivie, peut causer des blessures.

VORSICHT - Dieses im Handbuch und auf dem Werkzeug verwendete Symbol weisen den Benutzer darauf hin, daß bei einer nicht ordnungsgemäßen Beachtung eines Betriebsverfahrens oder -vorgangs chemische Gefährdungen bzw. Risiken vorliegen, die dem Bedienpersonal Körperverletzungen und Schäden verursachen können.

ПрЕДОСТЕрЕЖЕНИЕ - Этот символ используется в Руководстве и на установке для того, чтобы предупредить пользователя о существовании химических рисков, связанных с применением определенного режима или метода работы, и о том, что неправильное использование этого режима или метода работы может привести к травмам или телесным повреждениям производственного персонала.

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Danger, Warning, Caution, and Note Icons, continued

NOTE:

This symbol is used in the manual to alert the user to additional information, operating procedures, or conditions, which should be read and understood to aid in the use operation, or maintenance of the wafer polisher.

Ce symbole est utilisé dans le manuel pour avertir l'utilisateur de l'existence d'informations additionnelles, de procédures ou de conditions de fonctionnement, qu'il faut lire et comprendre pour bien faire fonctionner ou entretenir le polisseur de tranches.

Dieses im Handbuch verwendete Symbol weist den Benutzer auf zusätzliche Informationen, Betriebsverfahren oder Zustände hin, die zur Anwendung, zum Betrieb oder zur Wartung der Wafer-Poliermaschine gelesen und verstanden werden müssen.

Этот символ используется в Руководстве для того, чтобы предупредить пользователя о существовании дополнительной информации или правил работы, с которыми следует внимательно ознакомиться и в которых следует хорошо разобраться для того, чтобы эксплуатировать и обслуживать машину для полирования пластин надлежащим образом.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

This symbol (protective conductor terminal) is used to identify terminals in the Tool that are connected to the Tool's Protective Bonding Circuit by a conductor with a color other than the bi-color GREEN-AND-YELLOW. The Tool's Protective Bonding Circuit is connected to an external protective earth ground for safety purposes.

Ce symbole (terminal conducteur protecteur) est utilisé pour identifier les terminaux de l'outil qui sont connectés au circuit de liaison de l'outil par un conducteur qui a une couleur autre que les deux couleurs du fil bicolore VERT-ET-JAUNE. Le circuit de liaison de l'outil est connecté à une mise à la terre protectrice externe à des fins de sécurité.

Dieses Symbol (Schutzleiteranschluß) kennzeichnet Werkzeuganschlüsse, die mit einem Leitungsdrahts mit einer anderen Farbe als das zweifarbige GRÜN UND GELB an die Schutzerdeschaltung des Werkzeugs angeschlossen sind. Aus Sicherheitsgründen ist die Schutzerdeschaltung des Werkzeugs an eine externe Schutzerde angeschlossen.

Этот символ («Защитный зажим») используется для обозначения таких зажимов установки, которые соединены с ее схемой защитного заземления не двуцветным (ЗЕЛЕНЫМ и ЖЕЛТЫМ) проводом, Схема защитного заземления установки подключена к внешней системе защитного заземления.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

PE

This designation is used to identify the ONE terminal in the Tool that connects the Tools protective Bonding Circuit to the external protective earth conductor of the incoming supply system. This designation is used with a Protective Bonding Circuit icon shown above.

Cette désignation est utilisée pour identifier le SEUL terminal de l'outil qui connecte le circuit de liaison de l'outil au conducteur de mise à la terre protectrice du système d'alimentation entrante. Cette désignation est utilisée avec l'icone de circuit de liaison protectrice indiquée ci-dessus.

Diese Bezeichnung identifiziert den EINZIGEN Anschluß im Werkzeug, mit dem seine Schutzerdeschaltung mit der externen Schutzerde des Speiseversorgungssystem verbunden ist. Diese Bezeichnung wird zusammen mit dem oben gezeigten Symbol für die Schutzerdeschaltung benutzt.

Этот знак используется для обозначения ЕДИНСТВЕННОГО зажима установки, соединяющего ее схему защитного заземления с внешним заземляющим проводом системы электропитания. Данный знак используется вместе с изображенным выше графическим символом схемы защитного заземления.

continued on next page

Danger, Warning, Caution, and Note Icons, continued

This symbol (functional earth terminal) is used to identify a terminal in the Tool that is intended to be earthed for any functional purpose OTHER THAN SAFETY.

Ce symbole (terminal fonctionnel de mise à la terre) est utilisé pour identifier un terminal de l'outil qui doit être mis à la terre pour tout objectif fonctionnel AUTRE QUE LA SÉCURITÉ.

Dieses Symbol (funktioneller Erdungsanschluß) identifiziert eine Anschlußklemme im Werkzeug, die für einen ANDEREN Funktionszweck als für Sicherheit geerdet werden soll.

Этот символ («Зажим для функционального заземления») используется для обозначения зажима установки, предназначенного для заземления оборудования с какой-то функциональной целью, А НЕ С ЦЕЛЬЮ ЗАЩИТЫ.

Emergency OFF (EMO) Circuit

DANGER - DO NOT DISABLE OR COVER ANY EMO. DISABLING OR COVERING AN EMO CAN KEEP THE TOOL FROM BEING STOPPED IN CASE OF AN EMERGENCY. THIS CAN RESULT IN SEVERE INJURY OR LOSS OF LIFE.

DANGER - NE DÈBRANCHEZ OU NE COUVREZ AUCUN BOUTON D'ARRÍT D'URGENCE. SI VOUS DÈBRANCHEZ OU COUVREZ UN BOUTON D'ARRÍT D'URGENCE, VOUS RISQUEZ D'EMPÍCHER LA MACHINE DE S'ARRÍTER EN CAS D'URGENCE. VOUS RISQUEZ UNE BLESSURE SÈRIEUSE OU LA MORT.

GEFAHR - DIE NOTABSCHALTER DÜRFEN NICHT DEAKTIVIERT ODER VERDECKT WERDEN, DA SONST IM NOTFALL MÖGLICHERWEISE KEINE ABSCHALTUNG GESICHERT IST. DIES KANN SCHWERE VERLETZUNGEN BZW. DEN TOD VERURSACHEN.

ОПАСНОСТЬ - Запрещается отключать или закрывать колпачком любую кнопку аварийного останова. Отключение или закрытие такой кнопки лишит оператора возможности остановить установку в случае возникновения аварийной ситуации. Это может привести к тяжелой травме или несчастному случаю со смертельным исходом.

continued on next page

Emergency OFF (EMO) Circuit, continued

Introduction An Emergency Off (EMO) button should be pushed whenever an emergency condition is observed. This includes any possibility of injury or danger to personnel, or if the Tool begins to behave in an erratic or unexpected way. Pushing an EMO button will immediately remove all voltage from the Tool and stop the polisher motion. It will stop the upper head assembly and polish heads in whatever position they are in and shut down all communications between the user and the equipment from the control console. Any information that was not saved before the event will not be recorded. Refer to Figure 3-1 on page 3-18 and Table 3-1 on page 3-19 for the location and descriptions of the Emergency Off (EMO) buttons and switches. Refer to Figure 3-2 on page 3-20 for the EMO circuit wiring schematic.

continued on next page

Emergency OFF (EMO) Circuit, continued

Electrical Cabinet EMOs

All high voltage areas in the Electrical Cabinet are protected by an EMO circuit. When the Electrical Cabinet EMO circuit is broken, electrical power to the entire Tool is immediately shut off. Opening any of the EMO protected access doors will stop all Tool processes and disable further computer control. Recovery from an Electrical Cabinet EMO requires activating the control panel “reset” switch, and do the full “Tool Startup” on page 4-27 in the AvantGaard™ 676 User Manual. Refer to Figure 3-1 and Table 3-1 for the location and descriptions of the Emergency Off (EMO) buttons and switches.

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Emergency OFF (EMO) Circuit, continued

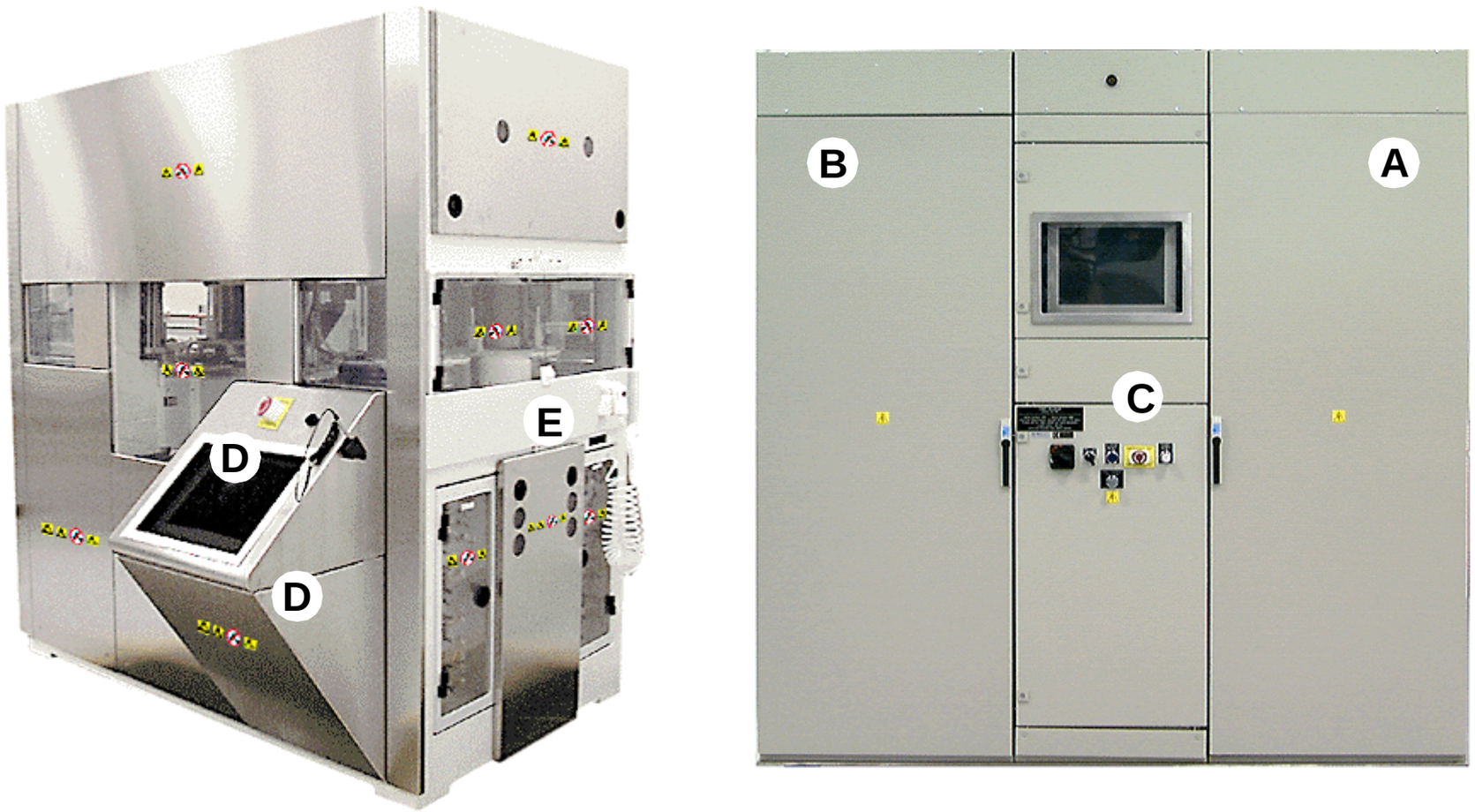

Figure 3-1. EMO Locations

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Emergency OFF (EMO) Circuit, continued

EMO Locations

Refer to Figure 3-1 on page 3-18 for the locations of the Emergency Off (EMO) buttons and switches. Refer to Figure 3-2 on page 3-20 for the EMO circuit wiring schematic.

Table 3-1. EMO Locations

Location	Description
A	Behind the low voltage swing panel on the right side of the Electrical Cabinet (1 location)
B	Behind the low voltage swing panel on the left side of the Electrical Cabinet (1 location)
C	Main Power Panel door on the Electrical Cabinet (1 location)
D	Operator Side Control Station and monitor cover (2 locations, one on top and one located between top and bottom halves of the cover)
E	All sides of the Tool frame have an EMO button (3 locations)

EMO Reset

Before resetting the Emergency Off button(s), position the Electrical Cabinet ON/OFF switch and Main Disconnect to OFF. To reset the EMO, twist the EMO button to release it, and do the full “Tool Startup” on page 4-27 in the AvantGaard™ 676 User Manual.

continued on next page

Emergency OFF (EMO) Circuit, continued

EMO Wiring All red wires in the Tool are part of the 24VAC EMO circuit. Figure 3-2 shows the EMO circuit wiring schematic.

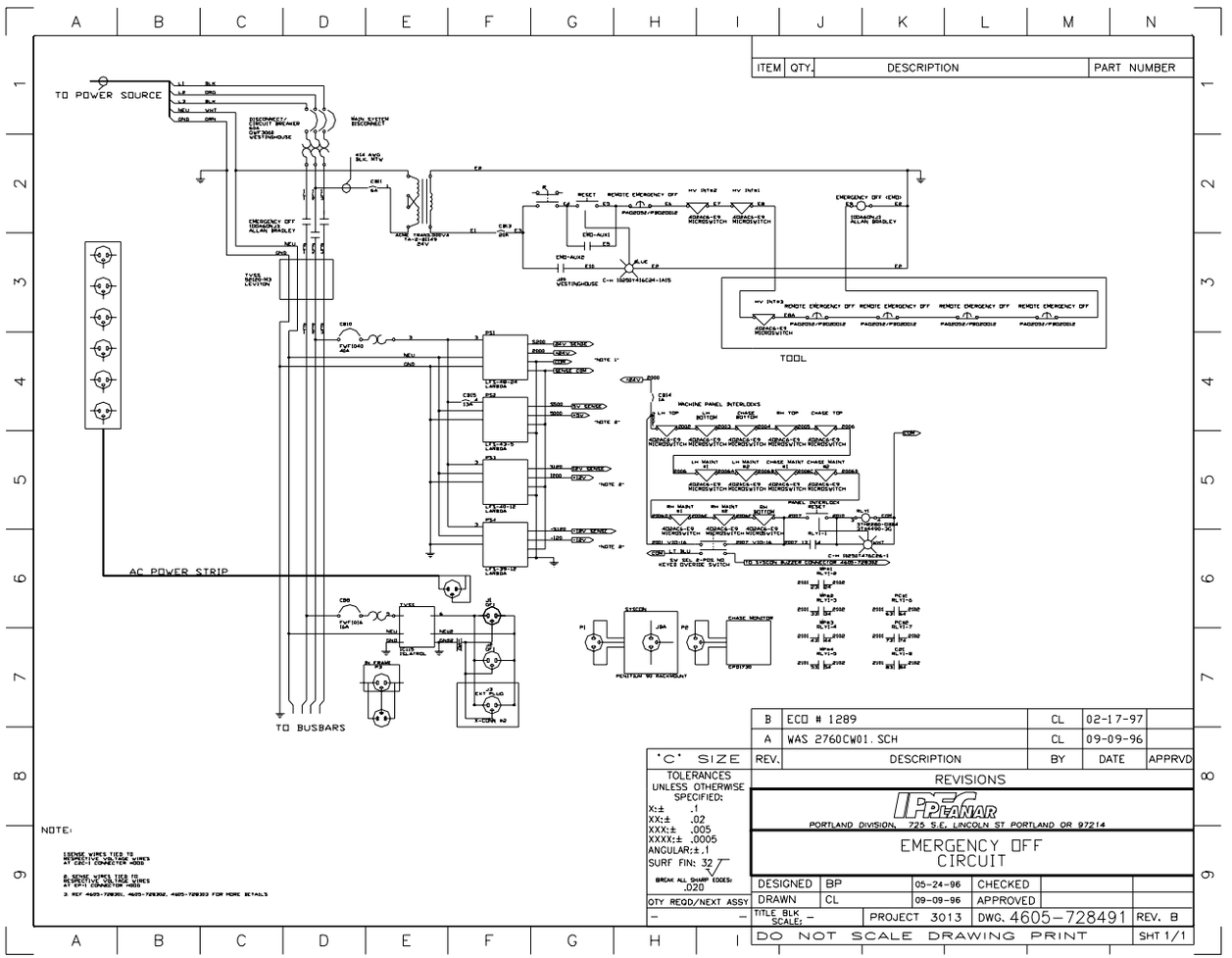
TO POWER SOURCE
AC POWER STRIP
TO BUSBARS
TOOL
ITEM QTY. DESCRIPTION PART NUMBER
B ECO # 1289 CL 02-17-97
A WAS 2760CW01.SCH CL 09-09-96
REV. DESCRIPTION BY DATE APPRVD
REVISIONS
'C' SIZE
TOLERANCES UNLESS OTHERWISE SPECIFIED:
PORTLAND DIVISION, 725 S.E. LINCOLN ST PORTLAND OR 97214
EMERGENCY OFF CIRCUIT
DESIGNED BP 05-24-96 CHECKED
DRAWN CL 09-09-96 APPROVED
PROJECT 3013 DWG. 4605-728491 REV. B
DO NOT SCALE DRAWING PRINT SHT 1/1

Figure 3-2. EMO Electrical Wiring Schematic

System Interlocks

Introduction System panel interlocks prevent personnel from opening potentially dangerous access panels and doors during Tool operation. All critical component access doors on the Tool are connected to the safety interlock circuit which is designed to stop machine operations if an interlock door is opened. These doors must be closed before the Tool can be operated.

If an access door is opened during operation, the system will stop all motion, an alarm tone will sound and an error message identifying the problem will be displayed on the control stations screens. System operation can only be resumed when the access door has been closed, and the operator issues a command to continue. An interlock violation shuts off all power to items using 24V or below. There are 12 panel interlocks. Refer to Figure 3-3 on page 3-23 for interlock locations and Table 3-2 on page 3-24 for descriptions.

Operation An important part of operational safety for the AvantGaard™ 676 are the system interlocks. System interlocks keep potentially dangerous access panels and doors from being opened during Tool operation. The system interlock circuit is designed to stop machine operations if an interlock door is opened.

When any interlocked panel or door is opened on the Tool during production, the circuit is tripped and a signal is sent to the computer. The panel interlock relay immediately stops all component movement and brings the system to a halt. An alarm tone sounds, and an error message is displayed on the terminal telling the operator of the interlock violation. After the interlocked panel has been closed, the operator then presses the panel reset (on Electrical Cabinet) and can continue operation.

continued on next page

System Interlocks, continued

WARNING - DO NOT OPERATE THE TOOL WITH ANY INTERLOCK OVERRIDDEN OR ANY EMO BUTTON DISABLED. SEVERAL MECHANICAL COMPONENTS IN THE PROCESS ENCLOSURES ARE CAPABLE OF CAUSING BODILY INJURY. ONLY QUALIFIED MAINTENANCE PERSONNEL MAY OPERATE THE TOOL WHILE AN INTERLOCK IS DEFEATED.

N'UTILISEZ PAS LA MACHINE APRËS AVOIR DÈBRANCHÈ DES INTERRUPTEURS DE VERROUILLAGE OU DES BOUTONS D'ARRÍT D'URGENCE. PLUSIEURS ÈLÈMENTS MÈCANIQUES SE TROUVANT ‡ L'INTÈRIEUR DES ENCEINTES DE TRAITEMENT PEUVENT CAUSER DES BLESSURES. SEUL, DU PERSONNEL D'ENTRETIEN QUALIFIÈ PEUT UTILISER LA MACHINE QUAND UN VERROUILLAGE EST DÈBRANCHÈ.

DAS WERKZEUG DARF NICHT MIT ÜBERSTEUERTEN VERRIEGELUNGEN ODER DEAKTIVIERTEN NOTABSCHALTERN BETRIEBEN WERDEN. INNERHALB DER SCHUTZABDECKUNGEN BEFINDEN SICH MEHRERE MECHANISCHE BAUTEILE, DIE KÖRPERVERLETZUNGEN HERVORRUFEN KÖNNEN. FALLS EINE VERRIEGELUNG ÜBERSTEUERT WIRD, DARF DIE MASCHINE NUR VON QUALIFIZIERTEM WARTUNGSPERSONAL BETRIEBEN WERDEN.

ПрЕДУПрЕЖДЕНИЕ - Запрещается пускать в ход установку при отключенном блокировочном устройстве или отключенной кнопке аварийного останова. Некоторые механические детали, находящиеся внутри корпусов технологического оборудования, способны нанести телесные травмы. В том случае, если какое-то из блокировочных устройств отключено, только квалифицированному обслуживающему персоналу разрешается пускать в ход установку.

System Interlocks, continued

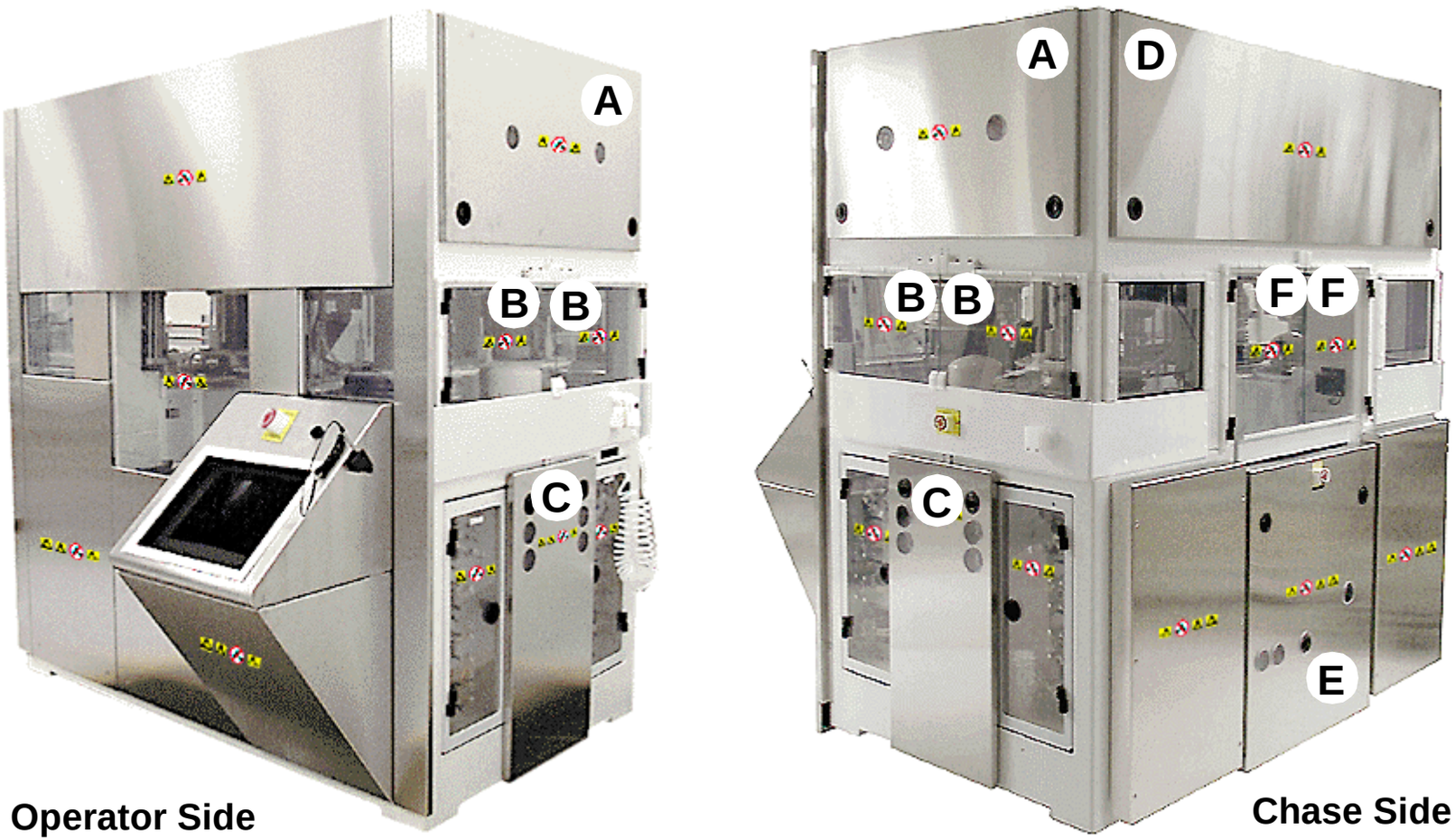

Figure 3-3. System Interlock Locations

continued on next page

System Interlocks, continued

Location Description

Refer to Figure 3-3 for the locations of the 12 system interlocks. The operator door interlocks include all doors and panels covering machine compartments. These are the compartments that the operator would be in or near during normal operation of the Tool. Opening an access doors will cause the Tool to halt. The interlocks can be over-ridden by pulling out the interlock switch actuator located behind the door. Closing the door will reset the interlock switch.

Table 3-2. System Interlock Locations and Descriptions

Location	Description
A	MP upper pneumatic exterior panels (2 locations)
B	Side access doors (4 locations)
C	MP lower pneumatic exterior panels (2 locations)
D	C2C upper pneumatic exterior panel (1 location)
E	C2C lower pneumatic exterior panel (1 location)
F	Chase side maintenance access doors (2 locations)

NOTE: **The bay side operator access door is an automatic (software controlled) door. It is not interlocked. It is lowered by a magnetic breakaway cylinder and is not considered to be a safety hazard.**

continued on next page

System Interlocks, continued

Normal Stop	Use the light pen to click the STOP ALL button to do a normal stop of the Tool from Production Mode. This will cause an orderly shutdown of the components by the SysCon software.

Alarm Messages

Introduction When a system violation or malfunction occurs, an EMO is pressed, or a system interlock violation occurs, an alarm and error message(s) will be given to the operator both visually and audibly. Visually, error messages are displayed on the control stations screens. These messages will identify the type of error and will usually display a question that will lead the operator to give a command solution.

Audible alarm tones, controlled by the System Control (SysCon) computer, accompany all error conditions and alert the operator to respond to a problem. There are two alarm speakers on the Tool, one on the operator control station next to the EMO, and the second on the Electrical Cabinet, center section on the top shelf. Both speakers use 24VDC from the C2C low voltage panel assembly.

System Malfunction When a component or process fails or exceeds a movement time limit, the alarm tone will sound and an error message will be displayed on the control stations screens.

The error messages displayed on the control station screens are listed in Chapter 7 of the AvantGaard™ 676 User Manual.

continued on next page

Alarm Messages, continued

Optional Light Tower

A 3-color light tower is mounted on the Tool to alert the operator of Tool status. See Figure 3-4 on page 3-28. The unit is mounted on the operator side of the Tool above the flat panel display. The light tower is a 24 VDC system with bulbs rated at 11 watts. See Table 3-3 for a description of the Tool conditions when each light comes ON.

Table 3-3. Light Tower Alarms

Light Color	Description
RED	Emergency, hazardous condition, immediate action required
YELLOW	Abnormal condition, impending hazardous condition, immediate action required
GREEN	Normal condition

continued on next page

Alarm Messages, continued

Figure 3-4. Light Tower

Mechanical Hazards

Introduction Before operating the Tool, maintenance personnel and Tool operators should read and understand the following mechanical hazards related to the AvantGaard™ 676 components, assemblies, and systems.

- “Wafer Head” on page 3-30
- “Polish Head Diaphragm” on page 3-32
- “Polish Head” on page 3-34
- “Advanced Pad Motion Option” on page 3-35
- “Drive Belts” on page 3-36
- “C2C Module Robot” on page 3-37
- “Hine® Z Axis Brake” on page 3-38
- “Operator Access Door” on page 3-39
- “Tool Doors” on page 3-41
- “Slurry Pumps” on page 3-42
- “Broken Wafers” on page 3-43

continued on next page

Mechanical Hazards, continued

Wafer Head

WARNING - DO NOT PUT YOUR HANDS OR TOOLS BETWEEN THE HEAD ASSEMBLIES WHEN THE WAFER HEAD IS COMING DOWN. THE TWO COMPONENTS OF THE HEAD ASSEMBLIES ARE THE WAFER AND POLISH HEADS. THE CYLINDER WHICH MOVES THE WAFER HEAD ASSEMBLY DOWN TO THE POLISH PAD CAN PRODUCE 4000 POUNDS OF FORCE. THE TOOL SIDE ACCESS DOORS AND THE SPRAY SHIELDS ARE CONNECTED TO INTERLOCKS TO PROTECT THE OPERATOR.

WARNING - NE PLACEZ PAS VOS MAINS OU DES OUTILS ENTRE LES ASSEMBLAGES DE TÊTE QUAND LA TÊTE DE PLAQUETTE EST EN TRAIN DE DESCENDRE. LES ASSEMBLAGES DE TÊTE SONT COMPOSÉS PAR DEUX ÉLÉMENTS : LA TÊTE DE PLAQUETTE ET LA TÊTE DE POLISSAGE. LE CYLINDRE QUI FAIT DESCENDRE L ASSEMBLAGE DE TÊTE DE PLAQUETTE JUSQU À LA PLAQUE DE POLISSAGE EST CAPABLE DE PRODUIRE UNE FORCE DE 4000 LIVRES. LES PORTES D ACCÈS SE TROUVANT SUR LES CÔTÉS DE LA MACHINE ET LES BOUCLIERS DU GICLEUR SONT CONNECTÉS À DES VERROUILLAGES POUR PROTÉGER L UTILISATEUR.

continued on next page

Mechanical Hazards, continued

WARNING - BEIM ABSENKEN DES WAFERKOPFES DIE HÄNDE ODER WERKZEUGE NICHT ZWISCHEN DIE KOPFAGGREGATE EINFÜHREN. DIE ZWEI KOMPONENTEN DER KOPFAGGREGATE WERDEN VON DEN WAFER- UND POLIERKÖPFEN GEBILDET. DER ZYLINDER, DER DAS WAFERKOPFAGGREGAT AUF DAS POLIERKISSEN ABSENKT, KANN ÜBER 1.800 KG DRUCK AUSÜBEN. ZUM SCHUTZ DES BEDIENERS SIND DIE SEITLICHEN ZUGANGSTÜREN DER MASCHINE UND DIE SPRÜHSCHILDER MIT VERRIEGELUNGEN VERBUNDEN.

ПрЕДУПрЕЖДЕНИЕ - Запрещается помещать руки или инструмент между узлами головок во время опускания головки для пластин. Узлы головок состоят из двух элементов – головки для пластин и полировальной головки. Цилиндр, перемещающий головку для пластин вниз к полировальной опоре, может развивать усилие до 400 фунтов. Для защиты оператора боковые двери для доступа внутрь установки и брызгозащитные щитки соединены с блокировочными устройствами.

continued on next page

Mechanical Hazards, continued

Polish Head Diaphragm

WARNING - KEEP BACK FROM THE POLISH DIAPHRAGM IF IT IS INFLATED WHILE THE WAFER HEAD IS IN THE UP POSITION. THE POLISH DIAPHRAGM IS INFLATED DURING POLISHING TO PRODUCE AN EVEN POLISH PRESSURE. IT IS POSSIBLE TO OVERINFLATE THE POLISH DIAPHRAGM, ESPECIALLY IF THE WAFER HEAD IS IN THE UP POSITION. OVER INFLATING THE POLISH DIAPHRAGM WILL CAUSE THE POLISH PAD TO BALLOON UP AND CAN BLOW THE POLISH PAD ASSEMBLY OFF OF THE POLISH HEAD.

AVERTISSEMENT - ÉCARTEZ-VOUS DU DIAPHRAGME DE POLISSAGE S IL EST GONFLÉ QUAND LES TÊTES DE PLAQUETTE SONT EN POSITION ÉLEVÉE. LE DIAPHRAGME DE POLISSAGE EST GONFLÉ PENDANT LE POLISSAGE POUR PRODUIRE UNE PRESSION UNIFORME DE POLISSAGE. IL EST POSSIBLE DE TROP GONFLER LE DIAPHRAGME DE POLISSAGE, SURTOUT QUAND LA TÊTE DE PLAQUETTE EST EN POSITION TOTALEMENT ÉLEVÉE. UN GONFLAGE EXCESSIF DU DIAPHRAGME DE POLISSAGE PEUT PROVOQUER UN BALLONNEMENT DU DIAPHRAGME ET PEUT ÉCARTER L ENSEMBLE DE PLAQUE DE POLISSAGE DE LA TÊTE DE POLISSAGE.

continued on next page

Mechanical Hazards, continued

WARNING - ABSTAND ZUR POLIERMEMBRAN HALTEN, WENN DIESE BEI ANGEHOBENEM WAFERKOPF AUFGEBLASEN IST. DIE POLIERMEMBRAN IST WÄHREND DES POLIERENS AUFGEBLASEN, UM EINEN GLEICHMÄßIGEN POLIERDRUCK AUSZUÜBEN. DIE POLIERMEMBRAN KANN ZU STARK AUFGEBLASEN WERDEN, BESONDERS WENN SICH DER POLIERKOPF IN DER MIT DER OBERSEITE NACH OBEN WEISENDEN POSITION BEFINDET. BEI EINER ÜBERMÄßIGEN AUFBLASUNG ERWEITERT SICH DAS POLIERKISSEN BALLONARTIG, UND DAS GESAMTE POLIERKISSENAGGREGAT KANN VOM POLIERKOPF LOSGEBLASEN WERDEN.

ПрЕДУПрЕЖДЕНИЕ - Следует держаться в отдалении от наполненной воздухом полировальной диафрагмы, когда головка для пластин находится в верхнем положении. Полировальная диафрагма наполняется воздухом на время полирования, благодаря чему создается равномерное полировальное давление. Существует вероятность чрезмерного раздутия полировальной диафрагмы, особенно когда головка для пластин находится в верхнем положении. Если полировальная головка чрезмерно раздута, полировальная опора приподнимется и может оторваться от полировальной головки.

continued on next page

Mechanical Hazards, continued

Polish Head

DO NOT PUT YOUR HANDS OR TOOLS BETWEEN THE POLISH HEAD WAVE GENERATOR AND THE DRAIN BASIN. THE POLISH HEAD ORBITS AT A RATE THAT CAN CAUSING DAMAGE OR PERSONAL INJURY IF YOUR HANDS OR TOOLS ARE BETWEEN THE WAVE GENERATOR AND THE DRAIN BASIN.

AVERTISSEMENT - NE PLACEZ PAS VOS MAINS OU DES OUTILS ENTRE LE GÉNÉRATEUR D ONDES DE LA TÊTE DE POLISSAGE ET LE BASSIN DE DRAINAGE. LA TÊTE DE POLISSAGE TOURNE À UNE VITESSE QUI PEUT CAUSER DES BLESSURES OU DES DOMMAGES SI VOS MAINS OU DES OUTILS SE TROUVENT ENTRE LE GÉNÉRATEUR D ONDES ET LE BASSIN DE DRAINAGE.

WARNING - DIE HÄNDE BZW. WERKZEUGE NICHT ZWISCHEN DEN WELLENGENERATOR DES POLIERKOPFES UND DAS ABFLUßBECKEN EINFÜHREN. DIE KREISFÖRMIGE BEWEGUNG DES POLIERKOPF FINDET MIT EINER GESCHWINDIGKEIT STATT, DIE BEI ANWESENHEIT VON HÄNDEN ODER WERKZEUGEN ZWISCHEN DEM WELLENGENERATOR UND DEM ABFLUßBECKEN ZU SACHSCHÄDEN ODER KÖRPERVERLETZUNGEN FÜHREN KANN.

WARNING - ПрЕДУПрЕЖДЕНИЕ - Запрещается помещать руки или инструмент между генератором волн, установленным на полировальной головке, и сливным резервуаром. Полировальная головка вращается по орбите со скоростью, при которой она может нанести телесное повреждение или травму в том случае, если между генератором волн и сливным резервуаром находятся руки или инструмент.

continued on next page

Mechanical Hazards, continued

Advanced Pad Motion Option

DO NOT PUT YOUR HANDS OR TOOLS BETWEEN THE ADVANCED PAD MOTION (APM) OPTION COMPONENTS. THE STEPPER MOTOR AND POLISH HEAD MOVEMENTS CAN CAUSE DAMAGE OR PERSONAL INJURY TO YOUR HANDS OR TOOLS.

AVERTISSEMENT - NE PLACEZ PAS VOS MAINS OU DES OUTILS ENTRE LE GÉNÉRATEUR D ONDES DE LA TÊTE DE POLISSAGE ET LE BASSIN DE DRAINAGE. LA TÊTE DE POLISSAGE TOURNE À UNE VITESSE QUI PEUT CAUSER DES BLESSURES OU DES DOMMAGES SI VOS MAINS OU DES OUTILS SE TROUVENT ENTRE LE GÉNÉRATEUR D ONDES ET LE BASSIN DE DRAINAGE.

WARNING - DIE HÄNDE BZW. WERKZEUGE NICHT ZWISCHEN DEN WELLENGENERATOR DES POLIERKOPFES UND DAS ABFLUßBECKEN EINFÜHREN. DIE KREISFÖRMIGE BEWEGUNG DES POLIERKOPF FINDET MIT EINER GESCHWINDIGKEIT STATT, DIE BEI ANWESENHEIT VON HÄNDEN ODER WERKZEUGEN ZWISCHEN DEM WELLENGENERATOR UND DEM ABFLUßBECKEN ZU SACHSCHÄDEN ODER KÖRPERVERLETZUNGEN FÜHREN KANN.

ПрЕДУПрЕЖДЕНИЕ - Запрещается помещать руки или инструмент между деталями механизма опережающего движения опоры. В этом случае при работе шагового двигателя и при перемещении полировальной головки они могут травмировать руки или повредить инструмент.

Mechanical Hazards, continued

Drive Belts

USE CAUTION IF YOU ARE WORKING ON THE MP LOWER PNEUMATIC PANELS NEXT TO THE LOWER POLISH HEAD DRIVE PULLEY AND BELT. THE LOWER POLISH HEAD DRIVE PULLEY AND BELT ARE EXPOSED AND ARE A PINCH HAZARD WHENEVER THE LOWER PNEUMATIC PANELS ARE REMOVED TO DO SERVICE.

AVERTISSEMENT - FAITES ATTENTION SI VOUS TRAVAILLEZ AUX PANNEAUX PNEUMATIQUES MP DU BAS PRÈS DE LA COURROIE ET DE LA POULIE SITUÉS EN BAS DE LA TÊTE DE POLISSAGE. LA COURROIE ET LA POULIE SITUÉS EN BAS DE LA TÊTE DE POLISSAGE SONT EXPOSÉS ET FONT COURIR UN DANGER DE PINÇAGE QUAND LES PANNEAUX PNEUMATIQUES DU BAS SONT ENLEVÉS POUR LE SERVICE.

WARNING - BEI DER ARBEIT AN DEN UNTEREN PNEUMATISCHEN MP-PANEELEN DER ANTRIEBSSCHEIBE UND DES ANTRIEBSRIEMENS DES UNTEREN POLIERKOPFES MUß VORSICHTIG VORGEGANGEN WERDEN. DIE ANTRIEBSSCHEIBE UND DER ANTRIEBSRIEMEN DES UNTEREN POLIERKOPFS LIEGEN FREI UND KÖNNEN BEI DER ABNAHME DER UNTEREN PNEUMATISCHEN PANEELE, Z.B. ZU WARTUNGSZWECKEN, EINKLEMMUNGEN VERURSACHEN.

WARNING - ПрЕДУПрЕЖДЕНИЕ - Следует проявлять особую осторожность при обслуживании нижних пневматических панелей МП, находящихся рядом с нижним шкивом и ремнем привода полировальной головки. Нижний шкив и ремень привода полировальной головки не закрыты ограждением, и существует опасность защемления при снятии нижних пневматических панелей с целью проведения обслуживания.

continued on next page

Mechanical Hazards, continued

C2C Module Robot

CAUTION - Be aware of the location of the robot, and its movements, when working in the center (C2C) area of the Main Tool. When working in the C2C or teaching robot Tool Points, the robot arm can hit you during radial or vertical movements. If you are hit by the robot, you can be injured or you may damage the wand.

ATTENTION - Faites attention et surveillez le robot quand vous travaillez autour du robot. Si vous travaillez dans l aire centrale (C2C) de la machine principale ou si vous éduquez le robot, le bras du robot peut vous heurter en bougeant verticalement ou en circulairement. Le robot peut vous blesser ou peut causer des dommages au batteur en vous heurtant.

VORSICHT - Bei der Arbeit in der Nähe des Roboters vorsichtig vorgehen und auf die Position des Roboters achten. Bei der Arbeit im mittleren Bereich (C2C) der Hauptmaschine, bzw. wenn der Roboter die Werkzeugpunkte erlernt, können Sie vom Roboterarm getroffen werden, wenn er radiale oder vertikale Bewegungen ausführt. Falls Sie vom Roboter getroffen werden, können Körperverletzungen oder Beschädigungen des Roboterarms auftreten.

CAUTION - ПрЕДОСТЕрЕЖЕНИЕ - При работе в центральной зоне (C2C) установки необходимо учитывать местонахождение робота и траекторию его перемещений. Во время работы в зоне C2C или настройки робота вас может ударить его манипулятор, движущийся в радиальном или вертикальном направлении. В этом случае вы можете получить травму или повредить щуп.

Mechanical Hazards, continued

Hine® Z Axis Brake

The Hine® robot has a fail-safe brake on the Z axis motor. The brake will release only when power is applied to it. When robot power is OFF, the brake prevents any vertical movement. The Hine® robot has an external safety brake release connector which can be used to energize the brake and allow the Z axis to be moved manually. The connector is wired to an interface bracket located on the C2C Upper Pneumatic panel. Each 676 has an external 24VDC power supply. The Z axis brake safety release circuit and external 24VDC power supply are to be used in emergency situations only. Energizing the Z axis brake release connector when robot servos are disabled or robot power is OFF will deactivate the Z axis brake and cause the robot link arms to fall under their own weight.

continued on next page

Mechanical Hazards, continued

Operator
Access
Door

CAUTION - If it is necessary to lean into the C2C system through the operator access door opening, be aware of the operator access door. The operator access door is connected to a break-away cylinder. If the door is unnecessarily moved, it is possible for the door to break-away and hit you. Make sure you do not place your hands on a polish head, hit the robot, or break the operator access door if the door breaks away from the cylinder.

ATTENTION - Faites attention quand vous vous penchez dans le système C2C en passant par l ouverture de la porte d accès de l utilisateur. La porte d accès de l utilisateur est connectée au cylindre de largage. En cas de mouvement inutile de cette porte, elle peut être larguée et vous heurter. Assurez-vous de pas placer vos mains sur une tête de polissage, de ne pas heurter le robot ou de ne pas casser la porte d accès de l utilisateur si la porte est larguée du cylindre.

VORSICHT - Vorsichtig vorgehen, wenn es notwendig ist, daß Sie sich durch die Bedienerzugangstür in das C2C-System hineinbeugen. Diese Zugangstür ist mit einem Losbrechzylinder ausgestattet. Bei unnötiger Bewegung der Tür kann diese losbrechen und auf Sie fallen. Es muß daher sichergestellt werden, daß Sie bei einem Losbrechen der Tür vom Zylinder den Polierkopf nicht mit den Händen berühren oder auf den Roboter fallen oder die Bedienerzugangstür brechen.

CAUTION - ПрЕДОСТЕрЕЖЕНИЕ - В том случае, если необходимо наклониться вовнутрь зоны C2C через проем открытой двери для доступа оператора, следует помнить о существовании этой двери. Дверь для доступа оператора соединена с разъединяющим цилиндром. Если ее двигать без нужды, она может отсоединиться от цилиндра и вас ударить. Ни в коем случае не следует помещать руки на полировальную головку или ударять по роботу или двери для доступа оператора, когда эта дверь отошла от цилиндра.

Mechanical Hazards, continued

NEVER REACH INTO ANY POLISH STATION WHILE THE TOOL IS OPERATING. MECHANISMS START AUTOMATICALLY AND CAN RESULT IN INJURY TO PERSONNEL. ALWAYS END EACH AUTOMATIC OPERATION AND WAIT FOR ALL MECHANISMS TO COME TO A COMPLETE STOP BEFORE REACHING INTO ANY TOOL STATION.

NE TOUCHEZ JAMAIS ‡ UNE STATION DE POLISSAGE QUAND LA POLISSEUSE EST EN FONCTIONNEMENT. DES MÈCANISMES SE METTENT AUTOMATIQUEMENT EN MARCHE ET PEUVENT OCCASIONNER DES BLESSURES. ARRÍTEZ TOUJOURS TOUTES LES OPÈRATION AUTOMATIQUEMENT ET ATTENDEZ QUE TOUS LES MÈCANISMES S'ARRÍTENT COMPLËTEMENT AVANT DE TOUCHER ‡ LA STATION DE POLISSAGE.

WÄHREND DES BETRIEBS DER POLIERMASCHINE, DARF NICHT IN DIE POLIERSTATION EINGEGRIFFEN WERDEN. DIE MASCHINENMECHANISMEN STARTEN AUTOMATISCH UND KÖNNEN ZU KÖRPERVERLETZUNGEN DES PERSONALS FÜHREN. VOR DEM EINGREIFEN IN EINE POLIERSTATION MUß IMMER ERST DER AUTOMATIKBETRIEB BEENDET UND DER VÖLLIGE STILLSTAND ALLER MECHANISMEN ABGEWARTET WERDEN.

ПрЕДУПрЕЖДЕНИЕ - Не допускается помещать руки вовнутрь какой-либо полировальной станции во время работы установки. Ее механизмы начинают работать автоматически и могут нанести травму. Во всех случаях перед тем, как поместить руки вовнутрь какой-либо полировальной станции, необходимо подождать, пока не окончится автоматический цикл работы и пока все механизмы полностью не остановятся.

Mechanical Hazards, continued

Tool Doors

USE CAUTION WHEN OPENING AND CLOSING THE TOOL DOORS. THE DOORS CAN PRESENT A PINCH HAZARD.

FAITES ATTENTION EN OUVRANT ET EN FERMANT LES ENCEINTES DE TRAITEMENT. VOUS RISQUEZ DE VOUS PINCER AVEC CES ENCEINTES DE TRAITEMENT.

WARNING - BEIM ÖFFNEN UND SCHLIEßEN DER SCHUTZABDECKUNGEN VORSICHTIG VORGEHEN. DIE SCHUTZABDECKUNGEN KÖNNEN EINKLEMMUNGEN VERURSACHEN.

WARNING - ПрЕДУПрЕЖДЕНИЕ - Следует соблюдать осторожность при открытии и закрытии дверей установки. При этом возникает опасность защемления.

continued on next page

Mechanical Hazards, continued

Slurry Pumps

NEVER OPERATE THE SLURRY PUMPS WITHOUT THE PLASTIC PROTECTIVE COVER IN PLACE. TOUCHING THE SLURRY PUMP DURING WAFER PROCESSING CAN RESULT IN SEVERE PERSONAL INJURY. AVOID CONTACT WITH THE SLURRY PUMP ROLLERS BY KEEPING THE PLASTIC PUMP COVERS IN PLACE DURING OPERATION.

NE FAITES JAMAIS FONCTIONNER LES POMPES ‡ BOUE SANS LEUR COUVERCLE DE MATIËRE PLASTIQUE. SI VOUS TOUCHEZ ‡ LA POMPE ‡ BOUE PENDANT LE TRAITEMENT DES TRANCHES, VOUS RISQUEZ DES BLESSURES GRAVES. ...VITEZ TOUT CONTACT AVEC LES ROULEAUX DE LA POMPE ‡ BOUE EN LAISSANT EN PLACE LES COUVERCLES DE MATIËRE PLASTIQUE PENDANT LE FONCTIONNEMENT DE LA MACHINE.

WARNING - DIE SUSPENSIONSPUMPEN NUR MIT AUFGESETZTER KUNSTSTOFFSCHUTZABDECKUNG BETREIBEN. EINE BERÜHRUNG DER SUSPENSIONSPUMPE WÄHREND DER WAFERBEARBEITUNG KANN SCHWERE KÖRPERVERLETZUNGEN VERURSACHEN. UM EINE BERÜHRUNG DER SUSPENSIONSPUMPENWALZEN AUSZUSCHLIEßEN, MÜSSEN DIE KUNSTSTOFFPUMPENABDECKUNGEN WÄHREND DES BETRIEBS AUFGESETZT BLEIBEN.

WARNING - ПрЕДУПрЕЖДЕНИЕ - Запрещается запускать насосы подачи суспензии, если не установлен пластмассовый защитный кожух. Прикосновение к насосу для подачи суспензии во время обработки пластин может привести к серьезной травме. Для того, чтобы избежать прикосновения к барабанам насоса для подачи суспензии, работающие насосы должны быть закрыты пластмассовыми ограждениями.

continued on next page

Mechanical Hazards, continued

Broken Wafers

CAUTION - Use caution if a wafer breaks during the polishing process. Broken wafer shards are very sharp and can cause injury. Wear rubber gloves when picking up wafer pieces.

ATTENTION - Faites attention si une tranche se brise pendant le processus de polissage. Les Èchardes de tranche de silicium sont trËs pointues et peuvent occasionner des blessures. Portez des gants de caoutchouc quand vous ramassez les Èclats de tranche.

VORSICHT - Falls eine Wafer während des Polierens bricht, muß vorsichtig vorgegangen werden. Die Wafer-Scherben sind sehr scharf und können Verletzungen verursachen. Beim Umgang mit den Scherben Gummihandschuhe tragen.

CAUTION - ПрЕДОСТЕрЕЖЕНИЕ - Следует помнить о том, что в процессе полирования может сломаться пластина. Обломки сломанной пластины являются очень острыми и могут нанести травму. Следует подбирать кусочки пластин в резиновых перчатках.

Electrical Hazards

Introduction Before operating the Tool, maintenance personnel and Tool operators should read and understand the following electrical hazards related to the AvantGaard™ 676 components, assemblies, and systems.

- “EMO Protection” on page 3-45
- “Neutral Wire Color” on page 3-45
- “Mains Disconnect” on page 3-45
- “208, 380, or 460 VAC” on page 3-46
- “Facility High Voltage” on page 3-48
- “EMO Circuit” on page 3-49
- “Interconnect Boxes” on page 3-49
- “HV Panel Assemblies - Disabling Interlocks” on page 3-51
- “Main Power Panel Assembly” on page 3-53
- “C2C Robot Controller Panel Assembly” on page 3-53
- “Pad Conditioner HV Panel Assemblies” on page 3-53
- “High Voltage Panel” on page 3-54
- “Protective Earth Ground” on page 3-55
- “GFIC” on page 3-56
- “Grounding Rods” on page 3-56
- “Ground Bonding Path” on page 3-57
- “Lockout / Tagout Procedure” on page 3-58
- “SEMI S2-91, S2-93 Guidelines” on page 3-60

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Electrical Hazards, continued

EMO Protection

All the high voltage components in the Electrical Cabinet are mounted behind the low voltage swing panels. Opening a swing panel will break the EMO circuit and cause electrical power to be shut off to the entire Tool. Use extreme caution if the high voltage panels ever need servicing. Follow correct lockout and tagout procedures whenever maintenance is required in this area.

Neutral Wire Color

In accordance with applicable European requirements, light blue neutral wires are used in all electrical circuits in the Main Tool and in the Electrical Cabinet. A white label, with the word “Neutral”, is wrapped around the ends of each of the neutral wires to comply with domestic requirements.

[S/N 3031] This Tool was originally built with white colored neutral power wires in some locations. To comply with applicable CE regulations, these locations now have light blue heat shrink tubing, with a "NEU" label, to endmark the white neutral power wires.

DANGER - AN APPROVED FACILITIES DISCONNECT IS REQUIRED BETWEEN THE FACILITY MAINS ELECTRICAL POWER AND THE TOOL. IF AN APPROVED DISCONNECT IS NOT USED, THE FACILITY SIDE OF THE TOOL MAIN DISCONNECT WILL STILL BE CONNECTED TO FACILITY ELECTRICAL POWER EVEN AFTER THE TOOL MAIN DISCONNECT HAS BEEN POSITIONED TO OFF.

Mains Disconnect

Make sure an approved facilities disconnect is installed between the facility mains power supply and the Tool. If an approved disconnect is not used, the facility side of the Tool main disconnect will still be connected to facility electrical power even after the Tool main disconnect has been positioned to OFF.

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Electrical Hazards, continued

208, 380, or 460 VAC

DANGER - DO NOT TOUCH 208, 380, OR 460 VAC WIRES. THREE PHASE 208, 380, AND 460 VAC ARE VERY HAZARDOUS INDUSTRIAL POWER VOLTAGES THAT CAN CAUSE LOSS OF LIFE. ANY TWO WIRES OF THREE-PHASE AC (ALTERNATING CURRENT) POWER CAN SHOCK WITHOUT REFERENCE TO GROUND. THIS CAPABILITY CAUSES THREE-PHASE AC POWER TO ACT SIMILAR TO DC (DIRECT CURRENT) POWER WHICH MAY NOT ALLOW YOU TO LET GO OF A LIVE WIRE.

DANGER - NE TOUCHEZ PAS AUX C,BLES DE COURANT ALTERNATIF DE 208, 380 OU 460 VOLTS. LES COURANTS ALTERNATIFS TRIPHASÈS DE 208, 380 ET 460 VOLTS SONT DES COURANTS DE PUISSANCE INDUSTRIELLE TRËS DANGEREUX QUI PEUVENT PROVOQUER LA MORT. DEUX C,BLES DE COURANT ALTERNATIF TRIPHASÈ PEUVENT CAUSER UNE COMMOTION ÈLECTRIQUE SANS RÈFÈRENCE ‡ LA TERRE. ¿ CAUSE DE CETTE CARACTÈRISTIQUE, LE COURANT ALTERNATIF TRIPHASÈ AGIT COMME DU COURANT CONTINU ET EMPÍCHE LA PERSONNE DE SE DÈCOLLER D'UN C,BLE SOUS TENSION.

continued on next page

Electrical Hazards, continued

GEFAHR - KEINE 208 V, 380 V ODER 460 V WECHSELSPANNUNGSLEITUNGEN BERÜHREN. DIESE DREIPHASIGEN 208 V, 380 V UND 460 V WECHSELSPANNUNGEN SIND SEHR GEFÄHRLICHE, GROßTECHNISCHE STROMSPANNUNGEN MIT MÖGLICHERWEISE TÖDLICHER WIRKUNG. JEWEILS ZWEI BELIEBIGE LEITUNGSDRÄHTE DER DREIPHASIGEN WECHSELSPANNUNG KÖNNEN OHNE ERDUNG EINEN STROMSCHLAG VERURSACHEN. DADURCH WIRKT DIESER DREIPHASIGE WECHSELSTROM ÄHNLICH EINEM GLEICHSTROM, D.H. ES IST EVENTUELL NICHT MÖGLICH, EINEN STROMFÜHRENDEN DRAHT LOSZULASSEN.

ОПАСНОСТЬ - Запрещается прикасаться к проводам, находящимся под напряжением 208, 380 или 460 V переменного тока. Трехфазное напряжение 208, 380 или 460 V переменного тока является очень опасным промышленным напряжением и может убить человека. При прикосновении к любым двум незаземленным проводам, находящимся под трехфазным напряжением переменного тока, может иметь место поражение электрическим током. В подобном случае трехфазное напряжение переменного тока действует аналогично напряжению постоянного тока, и вы можете оказаться не в состоянии выпустить находящийся под напряжением провод.

continued on next page

Electrical Hazards, continued

DANGER - USE EXTREME CAUTION WHEN WORKING ON, OR NEXT TO, ANY HIGH VOLTAGE PANEL ASSEMBLIES IN THE ELECTRICAL CABINET. THE ELECTRICAL CABINET IS CONSIDERED A CLASS 4 ELECTRICAL HAZARD.

DANGER - FAITES EXTRÊMEMENT ATTENTION QUAND VOUS TRAVAILLEZ SUR UN ASSEMBLAGE DE PANNEAU DE HAUT VOLTAGE, OU À PROXIMITÉ, DANS L ARMOIRE ÉLECTRIQUE. L ARMOIRE ÉLECTRIQUE FAIT COURIR UN DANGER ÉLECTRIQUE DE CLASSE 4.

GEFAHR - BEI DER ARBEIT AN ODER IN DER NÄHE VON HOCHSPANNUNGS-PANEELAGGREGATEN IM STROMSCHRANK MIT GRÖßTER VORSICHT VORGEHEN. DER STROMSCHRANK WIRD ALS ELEKTRISCHE GEFAHR DER KLASSE 4 EINGESTUFT.

ОПАСНОСТЬ - Следует проявлять особую осторожность при обслуживании любых узлов, находящихся на панелях высокого напряжения в электрошкафу, или во время работы поблизости от этих узлов. По опасности поражения электрическим током электрошкаф относится к категории 4.

Facility High Voltage

The AvantGaard™ 676 is powered by 208 volts AC, 3 phase, 60 amp service. Facility high voltage enters the Electrical Cabinet main power panel at the main disconnect. After System Start-up, electrical power for the high voltage panels is transferred along bus bars mounted behind the high voltage area of the Electrical Cabinet. The bus bars are sealed behind labeled panels. This area remains sealed, even during installation. The back panels are bolted into the main cabinet frame but are not interlocked because they are only removable with Tools. Refer to Figure 3-5 for the location of the high voltage components and assemblies.

continued on next page

Electrical Hazards, continued

EMO Circuit All the high voltage components in the Electrical Cabinet are mounted behind the low voltage swing panels. Opening a swing panel will break the EMO circuit and cause electrical power to be shut off to the entire Tool. Use extreme caution if the high voltage panels need servicing. Follow lockout/tagout procedures whenever maintenance is required in this area.

Interconnect Boxes Electrical power is supplied from the Electrical Cabinet to the Main Tool through cables connected to the interconnect boxes. These boxes contain high voltage and are labeled as electrical hazards. The interconnect boxes are built and certified to NEMA 4 standards. The covers are electro-polished stainless steel and are only removable with tools. Do not remove these covers without first locking / tagging out the Tool. See “Electrical Hazards, continued” on page 3-58.

continued on next page

Electrical Hazards, continued

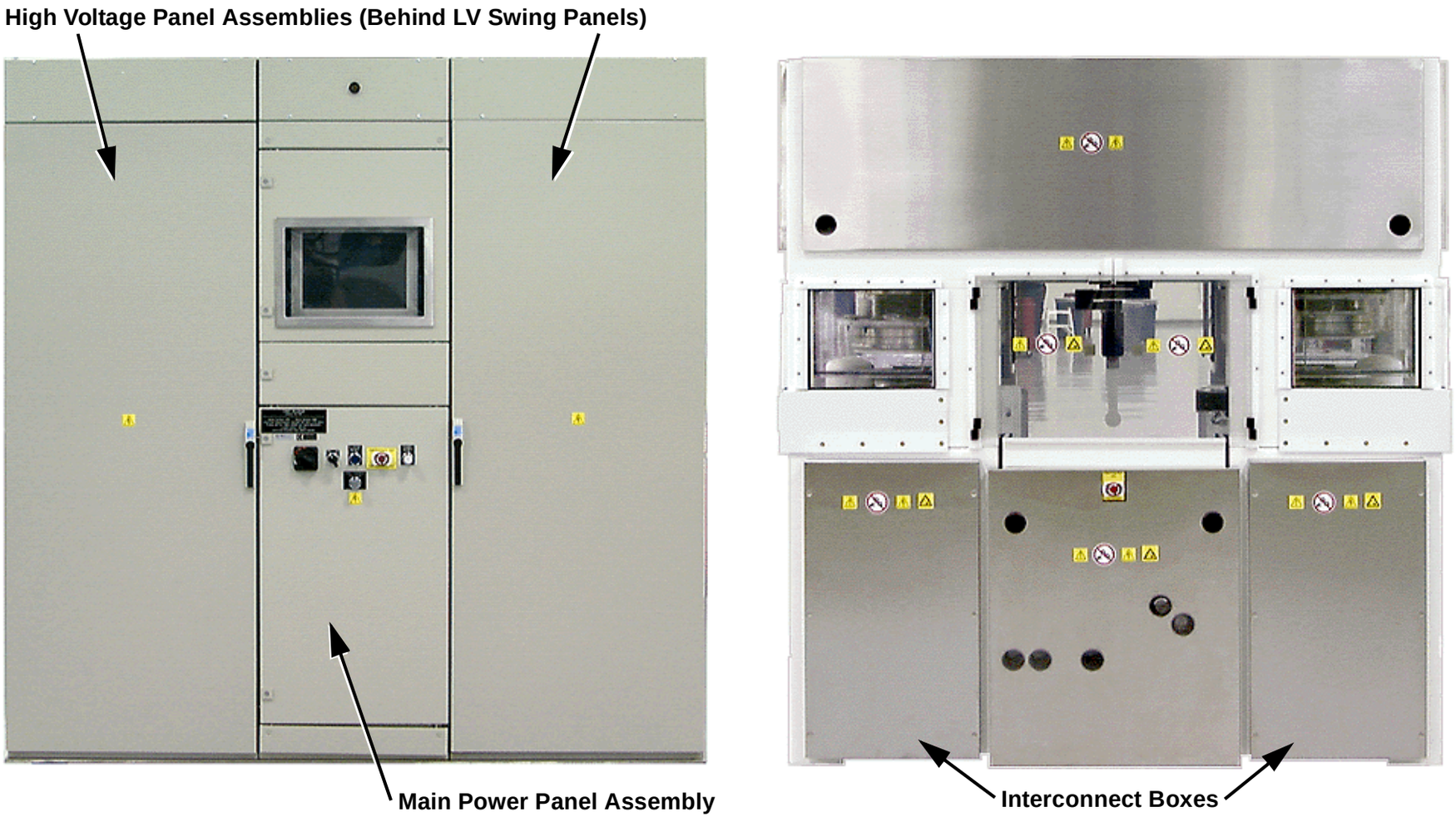

Figure 3-5. High Voltage Locations

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Electrical Hazards, continued

HV Panel Assemblies - Disabling Interlocks

DANGER - OPERATORS MUST NOT DISABLE INTERLOCKS OR REMOVE PANELS. DO NOT OPERATE THE TOOL WITH ANY INTERLOCK OVERRIDDEN OR ANY EMO BUTTON DISABLED. HIGH VOLTAGE IS DANGEROUS AND CAN CAUSE LOSS OF LIFE. ONLY QUALIFIED MAINTENANCE PERSONNEL FAMILIAR WITH HIGH VOLTAGE AND THE WAFER POLISHER MAY OPERATE THE TOOL WHILE INTERLOCKS ARE DISABLED OR PANELS ARE REMOVED FOR SERVICING.

DANGER - LES OPÈRATEURS NE PEUVENT PAS DÈBRANCHER LES INTERRUPTEURS DE VERROUILLAGE OU ENLEVER LES PANNEAUX PROTECTEURS. N'UTILISEZ PAS LA MACHINE APRËS AVOIR DÈBRANCHÈ DES INTERRUPTEURS DE VERROUILLAGE OU DES BOUTONS D'ARRÍT D'URGENCE. LE HAUT VOLTAGE EST DANGEREUX ET PEUT CAUSER LA MORT. SEUL, DU PERSONNEL D'ENTRETIEN QUALIFIÈ CONNAISSANT BIEN LE HAUT VOLTAGE ET LE POLISSEUR DE TRANCHES PEUT FAIRE FONCTIONNER LA MACHINE QUAND DES INTERRUPTEURS DE VERROUILLAGE SONT DÈBRANCHÈS OU DES PANNEAUX PROTECTEURS ENLEVÈS POUR L'ENTRETIEN.

continued on next page

Electrical Hazards, continued

GEFAHR - DIE BEDIENER DÜRFEN KEINE VERRIEGELUNGEN DEAKTIVIEREN ODER PANELE ENTFERNEN. DAS WERKZEUG DARF NICHT BETRIEBEN WERDEN, WENN EINE VERRIEGELUNG ÜBERSTEUERT BZW. EIN NOATABSCHALTER DEAKTIVIERT IST. HOCHSPANNUNGEN SIND GEFÄHRLICH UND KÖNNEN ZUM TOD FÜHREN. WERDEN BEI DER WARTUNG VERRIEGELUNGEN DEAKTIVIERT BZW. PANELE ENTFERNT, SO DARF DIE MASCHINE IN DIESEM FALL NUR DURCH QUALIFIZIERTES WARTUNGSPERSONAL, DAS MIT HOCHSPANNUNGEN UND DER WAFER-POLIERMASCHINE VERTRAUT IST, BETRIEBEN WERDEN.

ОПАСНОСТЬ - Операторы не должны отключать блокировочные устройства и снимать панели. Запрещается пускать в ход установку при отключенном блокировочном устройстве или отключенной кнопке аварийного останова. Высокое напряжение представляет опасность и может убить человека. Только квалифицированный обслуживающий персонал, которому известны правила работы под высоким напряжении, и который хорошо знаком с машиной для полирования пластин, может пускать в ход установку, когда отключены блокировочные устройства или сняты для обслуживания панели.

continued on next page

Electrical Hazards, continued

Main Power Panel Assembly

The main power panel assembly is located in the middle enclosure of the Electrical Cabinet and contains the AC and DC power distribution components and the facilities ground connection. There is one main power panel assembly for the Tool. Incoming three-phase power is current limited by the three-pole main circuit breaker. A 6 amp breaker supplies power to the 120/24VAC transformer that powers the Emergency-Off circuit. After going through the EMO contactor, the three-phase power is routed to the vertical bus bars located in the back of the end cabinet sections. A parallel transient voltage surge suppressor filters the AC power. An isolation transformer further conditions the AC power going to the system computer and its accessories. The panel interlock contactor is also located on this panel. A contact from the panel interlock contactor (local stop) is taken to each low voltage panel along with the DC power by a 10 pin connector. The +24VDC, +12VDC, -12VDC, and +5VDC power supply sense lines are tied to their respective output lines inside the hood of the C2C DC power 10 pin connector.

C2C Robot Controller Panel Assembly

The robot controller panel assembly contains the robot controller. The panel assembly is supplied by a 16A single-pole breaker. Startup transients are limited by a MOV (metal-oxide varistor) located on the panel terminal block. A contact from the local stop relay on the C2C low voltage panel assembly is connected to the robot controller EMO input by a 4 pin connector. A 25 foot (7.62 M) cable connects the robot to the robot controller.

Pad Conditioner HV Panel Assemblies

The pad conditioner high voltage panel contains the pad conditioner controller. There is one pad conditioner high voltage panel on each side of the Electrical Cabinet. The panel is supplied by a 16A single-pole breaker. Signals to the Tool are routed through one 24 pin connector (labeled PC-6). Signals to the pad conditioner low voltage panel are routed through one 16 pin connector (labeled PC-3).

continued on next page

Electrical Hazards, continued

High Voltage Panel

The high voltage panel contains a variable-frequency drive, three DC motor controllers, a slurry enable relay, a three-pole contactor, and two three-pole AC motor overload protectors. The high voltage panel is fed by a 16A three-pole breaker. Signals to the machine are routed through one 24 pin connector (labeled MP-6). Signals to the low voltage panel assembly are routed through one 16 pin connector (labeled MP-3). All labels conform to S2-93 standards.

continued on next page

Electrical Hazards, continued

DANGER - USE EXTREME CAUTION WHEN WORKING ON, OR NEXT TO, ANY HIGH VOLTAGE PANEL ASSEMBLIES IN THE ELECTRICAL CABINET. DO NOT OPERATE THE TOOL UNLESS IT IS GROUNDED TO A FACILITY PROTECTIVE EARTH GROUND.

DANGER - FAITES EXTRÊMEMENT ATTENTION QUAND VOUS TRAVAILLEZ SUR UN ASSEMBLAGE DE PANNEAU DE HAUT VOLTAGE, OU À PROXIMITÉ, DANS L ARMOIRE ÉLECTRIQUE.

GEFAHR - BEI DER ARBEIT AN ODER IN DER NÄHE VON HOCHSPANNUNGS-PANEELAGGREGATEN IM STROMSCHRANK MIT GRÖßTER VORSICHT VORGEHEN.

ОПАСНОСТЬ - Следует проявлять особую осторожность при обслуживании любых узлов, находящихся на панелях высокого напряжения в электрошкафу, или во время работы поблизости от этих узлов. Запрещается пускать в ход установку, если она не подключена к системе защитного заземления предприятия.

Protective Earth Ground

The AvantGaard™ 676 must be properly grounded to a facility protective earth ground. The external ground location for the Tool is located in the Electrical Cabinet and is identified by a protective earth label. Refer to Figure 3-6 for the location of the external ground connection.

continued on next page

Electrical Hazards, continued

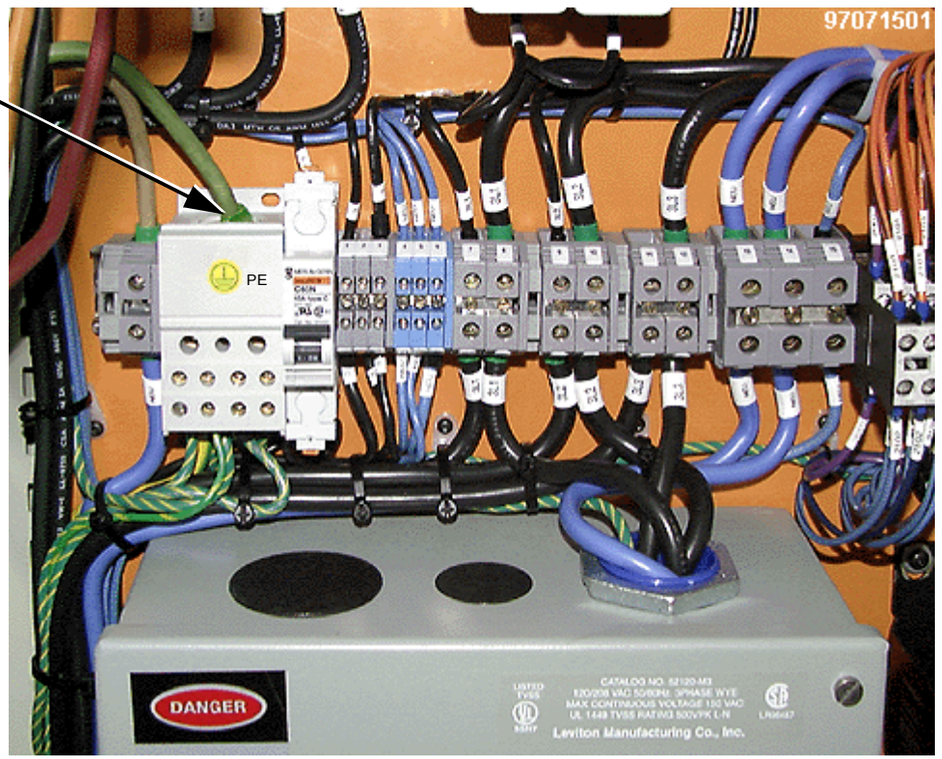

Figure 3-6. External (Protective Earth) Ground Location

GFIC

The outlet behind the Electrical Cabinet control station monitor is a Ground Fault Interrupt Circuit (GFIC). Power for the Operator side control station monitor, SysCon, light pens, and video splitter are supplied from this outlet junction box.

Grounding Rods

Electrical grounding rods are not required for the AvantGaard™ 676.

continued on next page

Electrical Hazards, continued

Ground Bonding Path

Use #10 AWG (or larger) green with yellow stripe wires to electrically bond the Main Tool (Interconnect Boxes) to the Electrical Cabinet (Main Power Panel Assembly)

[S/N 3031] This Tool was originally built with solid green colored earth ground wires in some locations. To comply with applicable CE regulations, these locations now have GRN/YEL bicolor heat shrink tubing to endmark the green earth ground wires.

Figure 3-7. Main Tool and Electrical Cabinet Ground Bonding Connections

continued on next page

Electrical Hazards, continued

Lockout / Tagout Procedure

Table 3-4 gives a sample procedure for lockout / tagout. Use this lockout / tagout procedure, or site approved lockout / tagout procedure that is in compliance with OSHA 1910-147, or other applicable regulations, before doing any maintenance or servicing requiring access to any high voltage panel assemblies, or hazardous areas of the Tool. The purpose of using a lockout / tagout procedure is to make sure that the Tool is stopped, and that all personnel are isolated from potentially hazardous areas. By locking out the equipment as described here, the Tool will be made safe for maintenance personnel from any unexpected startup or release of stored energy. Make sure the following procedure steps are strictly followed.

Table 3-4. Lockout / Tagout Procedure

Step	Instruction
1	Notify all affected employees that servicing or maintenance is required on the Tool and that during the service period, the Tool will be shut down and locked out.
2	Lockout should only be done by authorized employees. Authorized employees must be familiar with the types of hazards on each labeled panel assembly and must be trained to understand the other hazards in the Tool.
3	If the Tool is running, do the normal shut down procedures to stop wafer processing.
4	Position the main disconnect switch from ON to OFF.

continued on next page

Electrical Hazards, continued

Step	Instruction
5	Pull the lockout tab in the center of the switch. Lockout and tag the respective panel by using an approved lock. Tagout information should be labeled on lockout tags and include the operator's name, the date of lockout and a phone or extension number where the authorized tag removal person can be located.
6	To release stored pneumatic energy, shut off the pneumatic entry lockout / shutout. Push manual release button on all "heads up" valves. (4 heads on upper MP panel and 2 wafer combs on upper C2C panel.)

continued on next page

Electrical Hazards, continued

SEMI S2-91, S2-93 Guidelines

Semiconductor Equipment and Materials International, Inc. (SEMI) has identified a set of minimum performance-based environmental, health, and safety considerations that are used to identify potential hazards in the operation and maintenance of equipment for the semiconductor industry. The following S2-93 type classification guidelines are stricter than S2-91 guidelines. (S2-93 requires that power potentials and the presence of radio frequency be considered, as well as voltage potentials.) S2-93 guidelines were used while reviewing the AvantGaard™ 676 and compiling the following table. The following five types of energized electrical work are defined in S2-93.

Type 1 - Equipment is fully de-energized (electrically “cold”).

Type 2 - Equipment is energized. Live circuits are covered or insulated. Work is done at a remote location to prevent
accidental shock.

Type 3 - Equipment is energized. Live circuits are exposed and accidental contact is possible. Potential exposures are
less than 30 volts RMS, 42.2 volts peak, 240 volt-amps, and 20 Joules.

Type 4 - Equipment is energized. Live circuits are exposed and accidental contact is possible. Voltage potentials are
greater than 30 volts RMS, 42.2 volts peak, 240 volt-amps, 20 Joules, or radio frequency (rf) is present.

continued on next page

Electrical Hazards, continued

Type 5 - Equipment is energized and measurements and adjustment require physical entry into the equipment, or

equipment configuration will not allow the use of clamp-on probes.

Any procedure classified as a Type 3, 4, or 5 will be identified by a DANGER icon at the start of the procedure.

continued on next page

Electrical Hazards, continued

Type Classification

Each area in the AvantGaard™ 676 has been identified by type classification for maintenance and troubleshooting procedures. Refer to Table 3-5. Type classification for each area was determined by the most hazardous component in the area. For example, an area containing a Type 3 component and a Type 4 component would be classified as a Type 4 area.

Barriers

Component classifications were determined while all Tool power was applied, and all barriers (doors, panels, etc.) that restrict access to the areas (not to the components) were removed. It is recommended that barriers either designed into the components by the manufacturer, or added at the system level (for instance, shields over terminal blocks), not be removed during troubleshooting, unless absolutely necessary.

SpeedFam-IPEC labels all barriers concealing hazards in accordance with SEMI S1-90.

continued on next page

Electrical Hazards, continued

Tool Area Type Classification

The following table lists each Tool area, its type classification, the Type 3, 4, and 5 components in that Tool area, and the exposed potential of each component.

Table 3-5. S2-93 Tool Area Classifications

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
MP Low Voltage Panel Assemblies on Swing Panels of the Electrical Cabinet	3	CB1	24VDC
		CB2	5VDC
		F3	12VDC
		F4	12VDC
		PS1	24VDC
		Rly3	24VDC
		Rly8	24VDC
		TB5	5VDC
		TB12	12VDC
		TB12	12VAC
		TB24	24VDC
		TBI24	24VDC
		TB25	24VDC
		All Opto racks	24VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
Pad Conditioner Low Voltage Panel Assemblies on Swing Panels of the Electrical Cabinet.	3	CB1	24VDC
		CB2	5VDC
		PS1	24VDC
		Rly3	24VDC
		F3	12VDC
		TB5	5VDC
		TB12	12VDC
		TB24	24VDC
		TBI24	24VDC
		All OPTO22 Racks	24VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
Electrical Cabinet Low Voltage panels C2C Low Voltage Swing Panel Assemblies	3	CB1	24VDC
		CB2	5VDC
		F3	12VDC
		F4	12VDC
		PS1	24VDC
		Rly3	24VDC
		Rly4	24VDC
		TB5	5VDC
		TB12	12VDC
		TB-12	12VDC
		TB24	24VDC
		TBI24	24VDC
		All Opto 22 racks	24VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
Optional Brookside Endpoint Low Voltage Panel Assembly on Right Swing Panel of the Electrical Cabinet.	3	Advantech PCLD785	5VDC
		Advantech PCLD-8115	5VDC
		PCL-818L	5VDC
		CB1	24VDC
		CB2	5VDC
		F3	12VDC
		F4	12VDC
		TB1	5VDC
		TB2	12VDC
		TB3	24VDC
		TB4	24VDC
		TB8	5VDC
		TB9	5VDC
		TB10	12VDC
		Rly1	5VDC and 24VDC
		Entrelec 020	5VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
Optional Luxtron Endpoint Low Voltage Panel on right swing panel of the Electrical Cabinet	3	TB1	24VDC
		OPTO Board	24VDC
Optional Filmetrics Endpoint Low Voltage Panel on right swing panel of the Electrical Cabinet	3	F76 Light Source	24VDC
		PS1	5VDC
		TB2 (1-2)	5VDC
		All OPTO 22 Racks	24VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
MP High Voltage Panel Assemblies - behind Swing Panels in the Electrical Cabinet	4	VF1	208VAC
		Rly2	24VDC
		Rly2	110VAC
		Rly4	24VDC
		Rly4	208VAC
		FWF3016L	208VAC
		TB1	110VAC
		TB2	110VAC
		TB3	110VAC
		OL1	208VAC
		OL2	208VAC
		M1	110VAC
		M2	110VAC
		M3	110VAC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
Pad Conditioner High Voltage Panel Assemblies - behind Swing Panel in the Electrical Cabinet	4	CB7	110VAC
		CB30 (Pad Conditioner 2 panel only)	110VAC
		TB280 Org	24VDC
		TB-EP	110VAC
		TS2	110VAC
		Slo-Syn	110VAC
		Slo-Syn	90VDC
		KV-300 (Pad Conditioner 2 panel only)	24VDC
C2C High Voltage Panel Assembly behind right swing panel in Electrical Cabinet	4	CB7	110VAC
		Power Supply (Hine)	110VAC and 24VDC
		Robot Controller (Genmark)	110VAC
		TB1 (Hine)	24VDC
		TB4	110VAC
		TBCO79	24VDC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
High Voltage area in lower middle Section of the Electrical Cabinet	4	CB1	208VAC
		CB8	110VAC
		CB10	110VAC
		CB11	110VAC
		CB13	24VAC
		CB14	24VDC
		CB15	110VAC
		CB16	110VAC
		Cooling Fans (2) Option	24VAC
		SF1624	208VAC
		100-A60NJ3	24VAC
		100-A6ONJ3	208VAC
		IC115	110VAC
		TB1 (1-3)	110VAC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
High Voltage area in lower middle Section of the Electrical Cabinet (continued)	4	TB1 (7-8)	110VAC
		TB1 (9-10)	110VAC
		TB1 (11-12)	110VAC
		TB1 (16-18)	24VAC
		TB1 (19-22)	24VDC
		Power Conditioner	110VAC
		Rly1	24VDC
		T1	110VAC
		T1	24VAC

continued on next page

Electrical Hazards, continued

Tool Area	Type Classification of Area	Type 3, 4, & 5 Components	Exposed Potential of Components
High Voltage Area in bottom middle section of the Electrical Cabinet	4	-12VDC Power Supply	110VAC
		-12VDC Power Supply	12VDC
		12VDC Power Supply	110VAC
		12VDC Power Supply	12VDC
		5VDC Power Supply	110VAC
		5VDC Power Supply	5VDC
		24VDC Power Supply	110VAC
		24VDC Power Supply	24VDC
		TB (1-7)	5VDC
		TB (8-14)	12VDC
		TB (15-21)	12VDC
		TB (22-28)	24VDC
		TB1 (1-3) for Line Filter	208VAC

Chemical Hazards

Introduction Before operating the Tool, maintenance personnel and Tool operators should read and understand the following chemical hazards related to the AvantGaard™ 676 components, assemblies, and systems.

pH ranges pH ranges of 2-13 are the generally compatible with Tool hardware materials, surfaces, and consumables. pH ranges below 2, should be considered corrosive to certain hardware surfaces and materials, requiring consultation with SpeedFam-IPEC Engineering. Material Safety Data Sheets (MSDS) should be referred to and reviewed by user.

Slurry

CAUTION - Do not get slurry on your skin or in your eyes. Use protective eye wear and clothing when working with any slurry mixture. Wear an approved respirator for respiratory protection during any cleaning procedures. Colloidal silica slurry is a mild irritant to the skin and eyes. If the slurry mixture contacts your skin or eyes, flush the contacted area with water for 15 minutes and refer to the MSDS.

CAUTION - Évitez tout contact de la boue avec votre peau ou vos yeux. Utilisez des lunettes et des vêtements protecteurs quand vous manipulez le mélange boueux. Portez un appareil respiratoire approuvé pour protéger votre respiration pendant toute procédure de nettoyage. La boue de silice colloïdale est un irritant léger de la peau. Si le mélange boueux entre en contact avec votre peau ou vos yeux, nettoyez la zone touchée avec de l'eau pendant 15 minutes et consultez la fiche signalétique de sécurité.

continued on next page

Chemical Hazards, continued

VORSICHT - Die Suspension darf nicht mit Haut und Augen in Kontakt kommen. Beim Umgang mit allen Arten der Suspensionsmischung müssen Augenschutz und Schutzbekleidung getragen werden. Zum Atemschutz ist während aller Reinigungsverfahren eine zugelassene Atemschutzmaske zu tragen. Die kolloidale Siliziumsuspension wirkt leicht reizend auf Augen und Haut. Falls die Mischung mit Augen oder Haut in Berührung kommt, die betroffene Stelle 15 Minuten lang mit Wasser spülen und auf das Sicherheitsdatenblatt Bezug nehmen.

ПрЕДОСТЕрЕЖЕНИЕ - Необходимо предохранять кожу и глаза от попадания суспензии. При работе с суспензией необходимо носить защитные очки и защитную одежду. Во время чистки следует носить аттестованный респиратор. Суспензия коллоидного кремнезема вызывает небольшое раздражение кожи и глаз. Если такая суспензия попала на кожу или в глаза, следует промывать пораженный участок кожи или глаза в течение пятнадцати минут, а затем действовать согласно рекомендациям, содержащимся в справочнике по безопасному использованию материалов.

Report Any of the Following

- Irritation or burning of the respiratory system
- Pulmonary Edema
- Lung Inflammation
- Headache
- Coughing
- Difficulty Breathing
- Dizziness
- Chest Pains or Respiratory Failure
- Irritation of the tissues contacted. Chronic exposure to this compound can cause dermatitis.

Chemical Hazards, continued

CAUTION - Use protective eye wear and rubber gloves during wafer polisher operation and cleaning. Chemicals used during the wafer polishing process are hazardous to skin and eyes.

ATTENTION - Utilisez des lunettes protectrices et des gants de caoutchouc pendant le fonctionnement du polisseur de tranches et son nettoyage. Les produits chimiques utilisÈs pendant le processus de polissage des tranches sont dangereux pour la peau et les yeux.

VORSICHT - WÄHREND DES BETRIEBS UND DER REINIGUNG DER WAFER-POLIERMASCHINE AUGENSCHUTZ UND GUMMIHANDSCHUHE TRAGEN. DIE BEI DER WAFER-POLIERUNG VERWENDETEN CHEMIKALIEN KÖNNEN HAUT UND AUGEN GEFÄHRDEN.

ПрЕДОСТЕрЕЖЕНИЕ - Во время полирования и чистки пластин необходимо носить защитные очки и резиновые перчатки. Химикаты, применяемые в процессе полирования пластин, представляют опасность для кожи и глаз.

Personal Protective Equipment

- Wear Acid Gloves
- Acid Apron
- Safety Goggles/Face Mask/Breathing Apparatus

continued on next page

Chemical Hazards, continued

CAUTION - Make sure proper safety procedures and precautions are obeyed for the chemicals used at your site. Any change from the SpeedFam-IPEC recommended baseline chemistries must be analyzed by the customer for hazard potential. Consult SpeedFam-IPEC authorized personnel for any baseline chemistry changes.

ATTENTION - Assurez-vous que l'on respecte les bonnes procédures et précautions de sécurité relatives aux produits chimiques utilisés dans votre site. Le client doit faire une analyse des possibilités de danger pour tout changement par rapport aux produits chimiques de référence recommandés par l'SpeedFam-IPEC. Consultez le personnel autorisé de l'SpeedFam-IPEC pour tout changement par rapport aux produits chimiques de référence.

continued on next page

Chemical Hazards, continued

VORSICHT - Stellen Sie sicher, daß an Ihrer Arbeitsstätte die korrekten Sicherheits- und Vorsichtsmaßnahmen für die benutzten Chemikalien angewandt werden. Der Kunde muß jegliche Abweichungen von den durch die SpeedFam-IPEC empfohlenen Baseline-Chemikalien auf ein mögliches Risiko analysieren lassen.

ПрЕДОСТЕрЕЖЕНИЕ - Необходимо обеспечить соблюдение надлежащих правил и мер предосторожности при работе с химическими веществами, применяемыми на вашем предприятии. В том случае, если возникла необходимость во внесении каких-либо изменений в базовый химический состав, рекомендованный компанией SpeedFam-IPEC, необходимо дать оценку рискам, связанным с внесением такого изменения. Перед тем, как внести какое-либо изменение в базовый химический состав, следует проконсультироваться с уполномоченными сотрудниками компании SpeedFam-IPEC.

Fluids and Slurries

The fluids used in the AvantGaard™ 676 are DI Water and polishing slurries. DI Water is used for wafer wetting, slurry dilution, purging and is the solvent for all chemicals used in the Tool. The polishing slurries consist of chemicals dissolved in DI Water and abrasives, usually Aluminum Oxide (Alumina) and Silicon Dioxide (Silica). Metal polishing slurries are typically acidic, and oxide polishing slurries are typically alkaline.

continued on next page

Chemical Hazards, continued

Chemical Disposal

CAUTION - Obey all local, regional, and site-specific regulations for chemical disposal. A potential safety hazard exists if incompatible chemicals are disposed of at the same time. Exposure can cause sickness or loss of life.

ATTENTION - Respectez tous les règlements locaux, régionaux et particuliers au site, relatifs à l'évacuation des produits chimiques. Il existe un danger potentiel de sécurité si des produits chimiques incompatibles sont évacués ensemble. Ces déchets peuvent exploser en occasionnant des blessures ou des décès.

VORSICHT - Befolgen Sie alle lokalen, regionalen und standortspezifischen Vorschriften für die Entsorgung der Chemikalien. Bei gleichzeitiger Entsorgung von miteinander unverträglichen Chemikalien kann ein Sicherheitsrisiko entstehen. Eine Exposition kann gesundheitsschädlich sein oder zum Tod führen.

ПрЕДОСТЕрЕЖЕНИЕ - Необходимо соблюдать все местные, региональные и заводские правила удаления использованных химических веществ. Если удалять несовместимые химические вещества в одно и то же время, при этом возникает угроза безопасности. Воздействие таких веществ может привести к заболеваниям или к смертным случаям со смертельным исходом.

Chemical Hazards, continued

CAUTION - The AvantGaard™ 676 is not designed to use flammable chemicals or be operated in an explosive atmosphere.

ATTENTION - L'AvantGaard™ 676 n'est pas conçu pour utiliser des produits chimiques inflammables ou pour fonctionner dans une atmosphère explosive.

VORSICHT - Der AvantGaard™ 676 darf nicht mit entflammbaren Chemikalien oder in einer explosiven Atmosphäre betrieben werden.

ПрЕДОСТЕрЕЖЕНИЕ - Оборудование AvantGaard™ не рассчитано на работу с использованием воспламеняющихся химических веществ или во взрывоопасной атмосфере.

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Chemical Hazards, continued

Waste Disposal Methods

CAUTION - Refer to waste disposal methods on site supplied Material Safety Data Sheets (MSDS) when disposing of any chemicals or consumables. Process specific chemicals should be evaluated for potential hazards and disposed of in compliance with local and/or OSHA and Environmental Protection Agency standards.

ATTENTION - Référez-vous aux méthodes d'évacuation des déchets indiquées sur les feuilles signalétiques de sécurité de produit fournies sur le site, pour évacuer tout produit chimique ou produit inflammable. Pour évacuer des produits chimiques particuliers, vous devez évaluer leur danger potentiel et les évaluer conformément aux normes locales et/ou de l'OSHA et de l'Agence de protection de l'environnement.

VORSICHT - Beachten Sie beim Entsorgen von Chemikalien oder Verbrauchsmaterialien die von Ihrer Arbeitsstätte zur Verfügung gestellten Sicherheitsdatenblätter. Die verfahrensspezifischen Chemikalien sind auf mögliche Gefahren zu bewerten und müssen entsprechend der jeweiligen örtlichen und/oder behördlichen Arbeits- und Umweltschutzvorschriften entsorgt werden.

ПрЕДОСТЕрЕЖЕНИЕ - Необходимо удалять химические вещества или расходуемые материалы с помощью методов удаления отходов производства, указанных в применяемом на предприятии справочнике по безопасному использованию материалов. Следует оценить риски, связанные с использованием определенных химических веществ в производственном процессе, и их следует удалять в соответствии с местными нормами и/или нормами, установленными Управлением по безопасности труда и охране здоровья и Управлением по охране окружающей среды.

Chemical Hazards, continued

Deionized Water

CAUTION - Do not get DI water on your skin. DI (deionized) water will leach the ions out of your body and can cause sickness or loss of life if consumed.

ATTENTION - Évitez tout contact d eau déionisée avec votre peau. L eau déionisée attire les ions de votre corps et peut causer la maladie ou même la mort si vous la consommez.

CAUTION - Kein deionisiertes Wasser mit der Haut in Berührung kommen lassen. Deionisiertes Wasser löst die Ionen aus Ihrem Körper heraus und kann bei Verschlucken zur Krankheit oder sogar zum Tod führen.

ПрЕДОСТЕрЕЖЕНИЕ - Необходимо оберегать кожу от попадания деионизированной воды. Деионизированная вода вызывает выщелачивание ионов из организма, а при попадании в организм она может вызвать заболевание или смерть.

continued on next page

Chemical Hazards, continued

Ventilation/ Scrub Exhaust

The Tool should be connected to a scrub exhaust system at the following three connections points. The primary and secondary exhaust ventilation systems should be monitored for static pressure or flow, and have a Magnahelic alarm.

Exhaust Location	Description
System Scrub	1.5” (38.1 cm) diameter connection located at the lower chase side of the Tool. These lines from each head remove slurry fumes as well as collecting pneumatic exhaust. (flow approx. 50 SCFM)
Tool Base Evacuation	6.0” (15.2 cm) diameter connection located in the center of the bottom of the Tool. Gives a general evacuation of the lower Tool base area. (flow approx. 300 SCFM)

Material Safety Data Sheets

CAUTION - Your company must have a current MSDS readily available for each chemical used with the wafer polisher.

ATTENTION - Ce symbole est utilisé sur les étiquettes dans la machine pour identifier l'emplacement de la mise à la terre extérieure (terre protectrice).

VORSICHT - Ihre Firma muß für jede mit der Wafer-Poliermaschine benutzte Chemikalie ein aktuelles Sicherheitsdatenblatt bereithalten.

ПрЕДОСТЕрЕЖЕНИЕ - На вашем предприятии должен быть обеспечен легкий доступ к действующему справочнику по безопасному использованию материалов, содержащему необходимую информацию о каждом из химических веществ, используемых в машине для полирования пластин.

Material Safety Data Sheets (MSDS)

Figure 3-8 on page 3-84 shows a typical Material Safety Data Sheet (MSDS).

continued on next page

Material Safety Data Sheets, continued

Material Safety Data Sheet

DATE ISSUED | DATE REVISED | EMERGENCY TELEPHONE NUMBER

SECTION I - IDENTIFICATION OF MATERIAL

CHEMICAL NAME OR COMPOSITION

TRADE NAME & SYNONYMS

HAZARD RATING
FIRE
HEALTH REACT.

CHEMICAL FAMILY | MOLECULAR FORMULA

in Water

SECTION II - SIGNIFICANT COMPONENTS AND CONTAMINANTS

CAS NO.	COMPONENT	PERCENT	PERMISSIBLE EXPOSURE LIMIT	ACGIH Total Dust

SECTION III - PHYSICAL DATA

PHYSICAL CHARACTERISTICS

BOILING POINT | FREEZING POINT | SPECIFIC GRAVITY (WATER = 1.0)

VAPOR PRESSURE (mm OF MERCURY) | pH

VAPOR DENSITY (AIR = 1) | SOLUBILITY IN WATER

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (SPECIFY METHOD)

FIRE EXTINGUISHING MEDIA

SPECIAL FIRE FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARDS

NA

SECTION V - HEALTH HAZARD DATA

TOXICITY

EFFECTS OF OVEREXPOSURE: ACUTE

CHRONIC

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

SECTION VI - REACTIVITY DATA

GENERAL REACTIVITY

INCOMPATIBILITY (MATERIALS TO AVOID)

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION | CONDITIONS TO AVOID

SECTION VII - SPILL PROCEDURES / DISPOSAL REQUIREMENTS

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

WASTE DISPOSAL METHOD

CONTAINER DISPOSAL

SECTION VIII - SPECIAL PROTECTION INFORMATION (SPECIFY IN DETAIL)

EYE PROTECTION | GLOVES

RESPIRATORY

VENTILATION | OTHER

NA

SECTION IX - SPECIAL PRECAUTIONS

Storage Requirements:

Labeling:

SECTION X - SHIPPING REGULATIONS (D.O.T. NOMENCLATURE)

SECTION XI - REGULATORY INFORMATION

Figure 3-8. Material Safety Data Sheet - Front and Rear (Typical)

Cleaning and Spills

Introduction Remove slurry from the pumps, piping, and process surfaces by flushing with water. Line pressure in the pumps is limited to the head pressure generated by raising the slurry 24 inches to the process heads, approximately 1-2 pounds.

Follow Safety Guidelines and Fab Specifications posted at production site. Sites should make MSDS (Material Safety Data Sheets) documentation easily available for all chemical ingredients and handling precautions.

continued on next page

Cleaning and Spills, continued

Maintenance Cleaning

CAUTION - Do not use solvents to clean dried slurry. Slurry compound can be slightly alkaline. Wear an approved respirator for respiratory protection during any cleaning procedures. Using solvents can cause the suspended chemicals to precipitate and release hazardous vapors.

ATTENTION - N'utilisez pas de solvants pour nettoyer la boue sÈchÈe. La boue peut Ítre lÈgËrement alcaline. Portez un appareil respiratoire approuvÈ pour protÈger vos poumons pendant toute procÈdure de nettoyage. L'utilisation de solvants peut causer une prÈcipitation de produits chimiques en suspension et un dÈgagement de valeurs dangereuses.

CAUTION - Zur Reinigung der getrockneten Suspension keine Lösungsmittel verwenden. Die Suspension kann leicht basisch sein. Zum Atemschutz bei allen Reinigungsverfahren eine zugelassene Atemschutzmaske verwenden. Lösungsmittel können eine Absetzung der suspendierten Chemikalien verursachen, wodurch gefährliche Dämpfe freigesetzt werden können.

ПрЕДОСТЕрЕЖЕНИЕ - Не следует удалять засохшую суспензию с помощью растворителей. Суспензия может быть слегка щелочной. Во время чистки обязательно необходимо носить аттестованный респиратор. При использовании растворителей может произойти осаждение взвешенных химических веществ с выделением опасных паров.

Cleaning and Spills, continued

Controlling Spills

The Tool has a sloped drain monitored by a leak detection device. The drain is 0.50 inch (1.27 cm) diameter and the catch pan is 15.8 cubic feet (0.442 m^3). The leak detection system, located in the lower catch pan, will sound a system alarm if activated by leaking fluids. Follow any applicable Safety Guidelines and Fab Specifications posted at the production site. All customer sites must supply MSDS (Material Safety Data Sheet) documentation for all chemicals used at the site.

Airborne Noise Hazards

Introduction The following table lists the airborne noise emission levels recorded at 1 meter from the Tool. For a working shift of 8 hours, a steady sound level or 90 dBA is the maximum generally permitted, with marked reduction in allowable exposure times for higher sound levels. Use appropriate hearing protection when working near the Tool.

Table 3-6. AvantGaard™ 676 Sound Levels

Description	Load Station	Front CRT
Ambient (dBA)	67	66
Measurement (dBA)	71	73
ANSI S1.13 Correction Factor	-2.2	-1.0
Resulting Value (dBA)	68.8	72

Use the following examples to compare the noise level of the Tool with the noise levels in common indoor situations.

continued on next page

Airborne Noise Hazards, continued

Table 3-7. Noise Level Examples

Situation	Typical Noise Level (dBA)
Meeting and conference rooms	42 dBA
Private offices and small meeting rooms	38 - 47 dBA
Supervisor’s offices and reception rooms	38 - 52 dBA
Large offices and cafeterias	42 - 52 dBA
Laboratories, drafting rooms, and general office areas	47 - 56 dBA
Maintenance shops, computer rooms, and washrooms	52 - 61 dBA
Control and electrical equipment rooms	56 - 66 dBA
Manufacturing areas and foremen’s offices	66 dBA

General Hazards

Compliance Table 3-8 identifies AvantGaard™ 676 compliance to the various hazards and conditions.

Table 3-8. General Hazards

Hazard / Condition	Compliance / Responsibility
Fire Protection	Fire protection is controlled by the customer / facility and should comply with site posted regulations.
General/Facilities	Facilities safety issues are controlled by the customer / facility and should comply with site posted regulations.
Emergency Procedures	Emergency Procedures are controlled by the customer / facility and should comply with site posted regulations.
Chemical/Gas Delivery Systems	Chemical/Gas Delivery Systems are controlled by the customer / facility and should comply with site posted regulations.
Gas Detection/Alarms	Gas Detection/Alarms are controlled by the customer / facility and should comply with site posted regulations.
Process Effluent Handling Systems	Process Effluent Handling Systems are controlled by the customer / facility and should comply with site posted regulations.
Chemical Disposal Systems	Chemical Disposal Systems are controlled by the customer / facility and should comply with site posted regulations.
Industrial Hygiene	Industrial Hygiene is controlled by the customer / facility and should comply with site posted regulations.
Radiation	The AvantGaard™ 676 does not emit hazardous radiation.

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General Hazards, continued

Ergonomics The AvantGaard™ 676 complies with the requirements of the SEMI S2-93 Safety Guidelines for Semiconductor Manufacturing Equipment and complies with the applicable European Community (CE) requirements.

Laser Hazards

DANGER - AVOID DIRECT EYE EXPOSURE FROM THE LASER. CONTINUOUS DIRECT EYE EXPOSURE TO THE LASER BEAM MAY CAUSE EYE INJURY.

DANGER - ÉVITEZ L'EXPOSITION DIRECTE D'OEIL DU LASER. L'EXPOSITION DIRECTE CONTINUE D'OEIL AU RAYON LASER PEUT CAUSER DES DOMMAGES D'OEIL.

GEFAHR - VERMEIDEN SIE DIREKTE AUGE BERÜHRUNG VOM LASER. UNUNTERBROCHENE DIREKTE AUGE BERÜHRUNG ZUM LASERSTRAHL KANN AUGE BESCHÄDIGUNGEN VERURSACHEN.

ОПАСНОСТЬ - Необходимо защищать глаза от прямого воздействия лазерного луча. Продолжительное прямое воздействие лазерного луча может повредить глаз.e5

Compliance Avoid direct eye exposure from laser. The beam is emitted from an aperture at the front of the laser. This laser is supplied with the optional tool kit and is used for calibration and alignment procedures on the AvantGaard™ 676. This product conforms to all applicable standards of subchapter J,21 CFR CH 1.

Table 3-9. Laser Specifications

Beam Size @ Module Face	Energy Level	Wave Length	Class Type	Laser Type
3.0mm Dia.	4.2 mW	635 nm	Class IIIa	Red Laser Diode

S2-93 and CE Compliance

Compliance The AvantGaard™ 676 complies with the requirements of the SEMI S2-93 Safety Guidelines for Semiconductor Manufacturing Equipment and complies with the applicable European Community (CE) requirements.

Moving the Tool

WARNING - MAKE SURE SUFFICIENTLY TRAINED PERSONNEL AND PROPER EQUIPMENT ARE USED TO MOVE THE TOOL OR ELECTRICAL CABINET. THESE COMPONENTS ARE VERY HEAVY AND CAN CRUSH PERSONNEL OR CAUSE FACILITY DAMAGE IF HANDLED INCORRECTLY.

AVERTISSEMENT - ASSUREZ-VOUS QUE LE PERSONNEL SUFFISAMMENT QUALIFIÉ ET LE MATÉRIEL APPROPRIÉ SONT HABITUÉS POUR DÉPLACER MACHINE OU LE MODULE ÉLECTRIQUE. CES COMPOSANTS SONT TRÈS LOURDS ET PEUVENT ÉCRASER LE PERSONNEL OU ENDOMMAGER SERVICE SI MANIPULÉS INEXACTEMENT.

DANGER - ÜBERPRÜFEN SIE, DAß GENUG AUSGEBILDETES PERSONAL UND KORREKTE AUSRÜSTUNG BENUTZT SIND, DAS MASCHINE ODER DEN ELEKTRISCHEN SCHRANK ZU VERSCHIEBEN. DIESE BESTANDTEILE SIND SEHR SCHWER UND KÖNNEN PERSONAL ZERQUETSCHEN ODER TEILDIENSTBESCHÄDIGUNG VERURSACHEN, WENN SIE FALSCH ANGEFAßT WERDEN.

ПрЕДУПрЕЖДЕНИЕ - Если возникла необходимость в перемещении установки или электрошкафа, такая операция должна осуществляться в достаточной степени обученным персоналом. Эти изделия являются очень тяжелыми, и, если их перемещать ненадлежащим образом, они могут раздавить персонал или повредить оборудование или другое имущество предприятия.

continued on next page

Moving the Tool, continued

Moving the Main Tool

The Main Tool weighs approximately 6,500 lbs (2,948 kg). It can be lifted by any location on the bottom surface, except within 12" (30.5 cm) of the bottom center of the frame. Also, at the bottom right hand corner of the chase side of the Tool, an interlock wire is exposed. Be careful not to damage this wire if the Tool must be moved.

The Center-of-Gravity is very near to the geometric center of the Main Tool.

continued on next page

Moving the Tool, continued

Side loads can only be applied to the lower 3" (7.62 cm) of the frame on the front and lower 6" (15.2 cm) of the frame, up to 10" (25.4 cm) from the corners on the sides. SpeedFam-IPEC recommends that air bearings, or equivalent, are used to move and position the Main Tool.

Moving the Electrical Cabinet

The Electrical Cabinet weighs approximately 3,500 lbs (1,588 kg). Do not apply side loads to the cabinet at any location (all surfaces are sheet metal). SpeedFam-IPEC recommends that roller dollies, or equivalent, are used to move and position the Electrical Cabinet.

Chapter 4

Service Mode Operations

Contents This chapter contains the following topics:

Topic	See Page
Service Mode	4-2
C2C Service Mode	4-5
C2C Task List	4-7
C2C Serial Window	4-10
C2C Discrete I/O Window	4-11
C2C Analog I/O Window	4-13
MP Service Mode	4-15
MPL Project Menu	4-16
MP Discrete I/O Window	4-20
MP Analog I/O Window	4-22
MPL Control Menu	4-24

Service Mode

WARNING - MAKE SURE ALL PERSONNEL STAY A SAFE DISTANCE FROM THE TOOL WHEN IT IS IN SERVICE MODE. SERVICE MODE OPERATIONS EXPOSE PERSONNEL TO INCREASED RISKS AND MECHANICAL HAZARDS. THE TOOL WILL DO ANY COMMAND GIVEN, REGARDLESS OF THE CONDITION OF THE TOOL COMPONENTS OR ASSEMBLIES. DAMAGE TO PERSONNEL, EQUIPMENT, OR PRODUCT IS POSSIBLE UNTIL THE TOOL IS NO LONGER IN SERVICE MODE.

Overview Service Mode gives direct computer access to Tool components and systems. It is used during troubleshooting and regular maintenance to monitor and control various input and output (I/O) functions.

NOTE: **Refer to Chapter 4, Tool Operation and Chapter 5, Operational Interface in the User Manual, as required, for information about operating the Tool in Production Mode.**

Table 4-1. Elements of Service Mode

Element	Function
C2C Discrete	Controls all functions of the Cassette to Cassette (C2C) system components.
C2C Analog	Reads the Wand Position Sensors Inputs.
C2C Serial	Used when teaching robot Tool Points.
MP Discrete	Controls all functions of the microplanarizer (MP) module components.
MP Analog	Controls wafer / polish pressure, slurry pump flow rates, and spindle speed.

continued on next page

Service Mode, continued

Service Precautions

CAUTION - Use extreme caution when giving commands to the Tool in Service Mode. The Tool will do any command given in Service Mode, regardless of the condition of the Tool components or assemblies. It is possible to do severe damage to the Tool by commanding actions in the wrong order.

Service Mode allows maintenance personnel to directly manipulate the inputs and outputs of the MP. These I/Os can be changed regardless of the condition of the Tool components and assemblies.

When the Tool is in Service Mode, it is possible to command it to do movements and actions it would not normally do. It is possible to do severe damage to the Tool by commanding actions in the wrong order. For instance, it is possible to tell the carrier lift tower in the C2C to lower a wafer cassette, without having first rotated it over the cassette basin.

Service Mode

Table 4-2. Service Mode

Step	Action
1	Use the red selector buttons on the video switch box in the Electrical Cabinet control station, to select the appropriate computer.
2	Select Exit on the Production Mode menu bar. The computer will display the DOS prompt.

continued on next page

Service Mode, continued

Step	Instruction
3	At the DOS prompt, type **win** to start Windows®.
4	Display the Program Manager window, then double-click the Service icon.
5	The menu bar must read v.2.12F RUN ONLY. Click on File on the menu bar then select the appropriate project file name from the drop down menu. This will load the service program.
6	Make sure the Project Menu window contains the version number and correct subsystem (MPL or C2C).

Exiting Service Mode

Step	Instruction
1	Select Quit on the Project Menu menu bar to shut down Service Mode, without going to DOS.

NOTE: **Do not use Alt+F4 to close the windows. This command has been known to corrupt files.**

continued on next page

Service Mode, continued

Step	Instruction
2	Exit from Windows® to DOS by selecting File, Exit from the Program Manager menu bar.
3	Use the computer box reset switch to re-start the computer and the software. Select Ctrl+Alt+Del to softboot the software when no reset switch is available.

C2C Service Mode

Overview

The C2C Service Mode screens allow access to the I/O's for all the systems controlled / coordinated by the C2C computer system. The discrete (digital) I/O values can be read or changed from the C2C Discrete I/O Window. The Analog I/O values can be viewed in the C2C Analog I/O Window. The controls in the C2C Serial I/O Window can directly manipulate the robot and should only be used by maintenance personnel with Level 3 certification. The C2C Task List Window will run stand-alone routines on the C2C system.

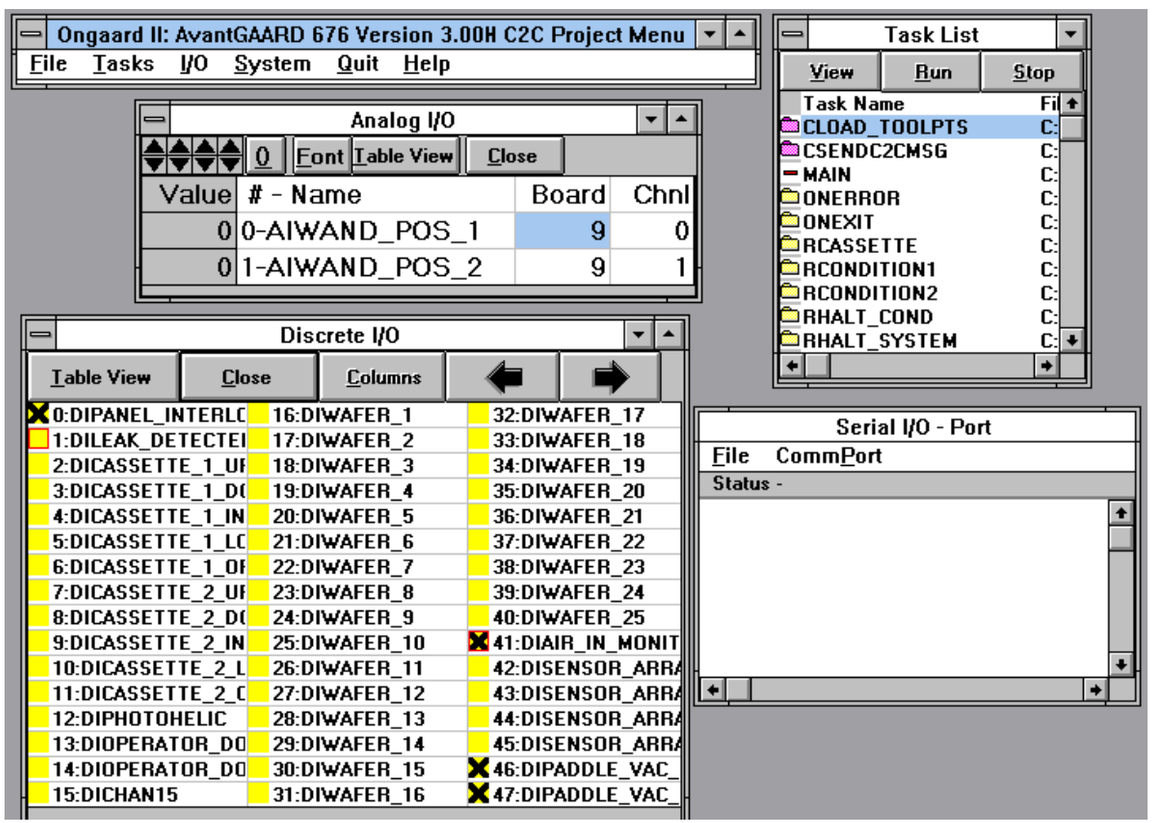

Figure 4-1. C2C Service Mode Screen

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C2C Service Mode, continued

C2C Project Menu Window

Table 4-3 gives descriptions of the menu options for the C2C Project Menu window.

Figure 4-2. C2C Project Menu Window

Menu Options

Table 4-3. C2C Project Menu Options

Button Name	Description
File	Exits the RUN version of OnGaard©.
Tasks	The Run Main Task option is the only option that should be used. It runs the main task, which positions the C2C components in their initialized locations.
I/O	Selects which I/O function windows will be displayed. Analog, Discrete, and Serial I/O function windows are available. The reset I/O selection returns values to their initialization conditions. Selecting Network will display the network mail addresses for other systems that report to the C2C.
System	Selecting Task Status will display the task list. Selecting Messages will display the messages reporting the status of the system. Messages are stored in the order in which they are received. Selecting Variables will display the Global Variables list.
Quit	Closes the active windows and exits the program.
Help	Help files are not available at this time.

C2C Task List

C2C Task List Window

Tasks displayed in the C2C Task List window are programs or sub-routines that the C2C runs during operations. Table 4-4 lists the task list titles for the C2C Task List window. Refer to Figure 4-3 to see the location of the C2C Task List window tasks.

Table 4-4. C2C Task List Key

Nomenclature	Description
R...	Tasks that start with an R are Runable - the task will only run, it cannot be changed.
C...	Tasks that start with a C are Callable - the task will be called by other sub-routines during a run, it cannot be changed.
Main and Onexit	These tasks run during start-up and shut-down respectively. Main runs the re-initialization, and Onexit is used to clean-up the system at shut-down.

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C2C Task List, continued

C2C Task List Window Refer to Table 4-4 for an explanation of the C2C Task List window tasks. Refer to Table 4-5 for an explanation of the C2C Task List window buttons and controls.

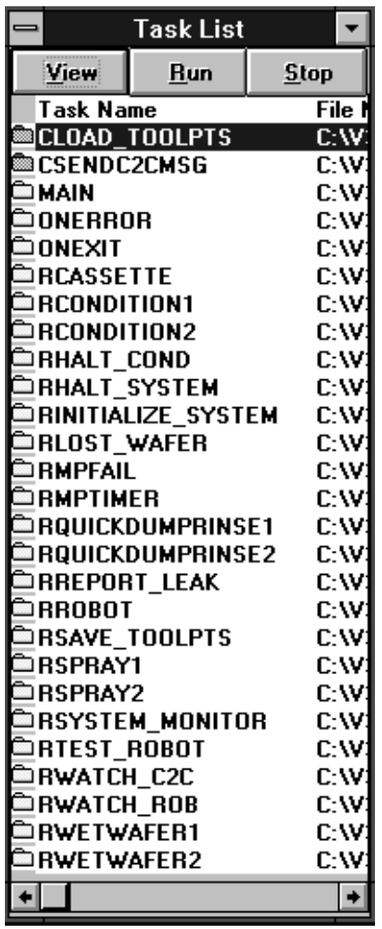

Figure 4-3. C2C Task List Window

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C2C Task List, continued

Controls

Refer to Figure 4-3 to see the location of the C2C Task List controls.

WARNING - MAKE SURE ALL PERSONNEL STAY A SAFE DISTANCE FROM THE TOOL WHEN IT IS IN SERVICE MODE. SERVICE MODE OPERATIONS EXPOSE PERSONNEL TO INCREASED RISKS AND MECHANICAL HAZARDS. THE TOOL WILL DO ANY COMMAND GIVEN, REGARDLESS OF THE CONDITION OF THE TOOL COMPONENTS OR ASSEMBLIES. DAMAGE TO PERSONNEL, EQUIPMENT, OR PRODUCT IS POSSIBLE UNTIL THE TOOL IS NO LONGER IN SERVICE MODE.

Table 4-5. C2C Task List Controls

Button Name	Description
View	Allows single stepping through the selected task. An “eye” icon will appear next to the folder when selected. Single step through the program using Step (the current line number is displayed) or allow the Tool to complete the program by selecting Stop Step. Only use Stop Step if you are sure of what Tool activities the code will do. If Skip Step is used, BE AWARE of the steps you are skipping. It is possible to skip steps that can cause severe damage to the Tool.
Views Mode window.	Click on Set Step to allow the next line to be completed to be selected. The backgound color will change to indicate Set Step is active. Click on the line. Select Set Step to move to that line.
Run	Starts the highlighted task.
Stop	Ends the highlighted task.

continued on next page

C2C Task List, continued

NOTE: **Highlighting a running task and hitting the <ESC> key will halt the process immediately. When a task is running, a red plus sign will appear in the place of the folder icon. When a task has completed running a red minus sign will appear in the place of the folder icon. If a task has an error in it, a red circle will appear in the place of the folder icon.**
If a red circle appears, call a SpeedFam-IPEC service technician or SpeedFam-IPEC.

C2C Serial Window

C2C Serial I/O Window

The Serial I/O drop down menu allows the robot to be directly operated and requires Level 3 certification.

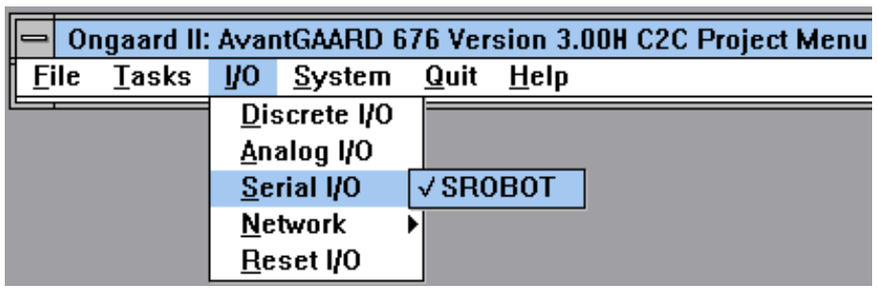

Figure 4-4. C2C Serial I/O Window

C2C Discrete I/O Window

C2C Discrete I/O Window

The C2C Discrete I/O window displays the channel numbers the computer addresses, and the function that channel operates or reads. It is possible to change the outputs, or read the value of the inputs, from this screen. Refer to Table 4-6 for a description of the C2C Discrete I/O window controls. Refer to Appendix B for a complete list of the C2C Discrete I/Os.

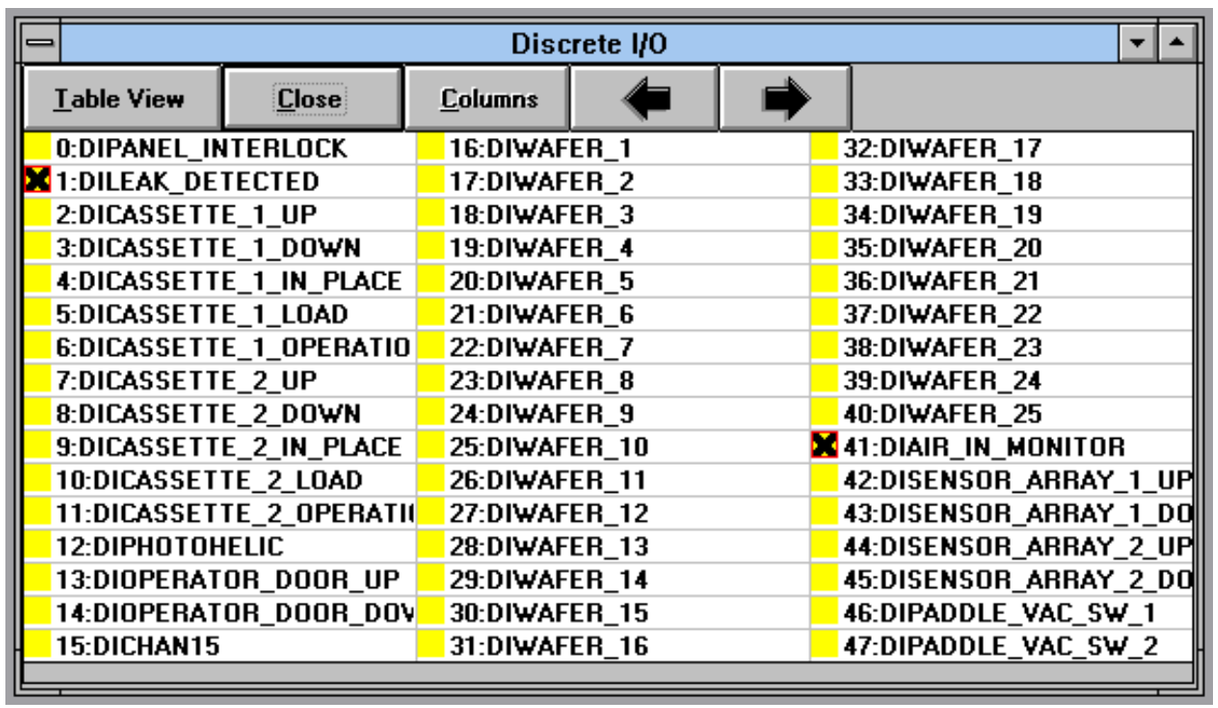

Figure 4-5. C2C Discrete I/O Window

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C2C Discrete I/O Window, continued

Controls Refer to Figure 4-5 to see the location of the C2C Discrete I/O window buttons and controls.

Table 4-6. C2C Discrete I/O Window Controls

Button Name	Description
Table View	Allows the channel numbers to be redefined and all functions locked out.
Close	Closes the C2C Discrete I/O window.
Columns	Allows the default of 3 columns of I/O viewing at a time to cycle and can be expanded to a maximum of 9 columns.
Arrow Keys	The large arrow keys at the top of the screen allow you to scroll through the table when it is listed by name.

NOTE: **Inputs and outputs are referenced from the computers point of view. An input is a signal going into the computer from the system, and an output is a signal going from the computer to the system.**

Inputs are shaded Yellow, outputs are Gray. An “x” indicates that the I/O is active.

It is necessary to double-click on any output that you wish to activate or de-activate.

Change conditions by double-clicking on the output to change. The width of the MP Discrete I/O window can be changed, if required, to read the titles more clearly.

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C2C Analog I/O Window

C2C Analog I/O Window

The C2C Analog I/O window displays the wand position sensor information. Refer to Table 4-7 for a description of the C2C Analog I/O window controls. Refer to Appendix B for a complete list of the C2C Analog I/Os.

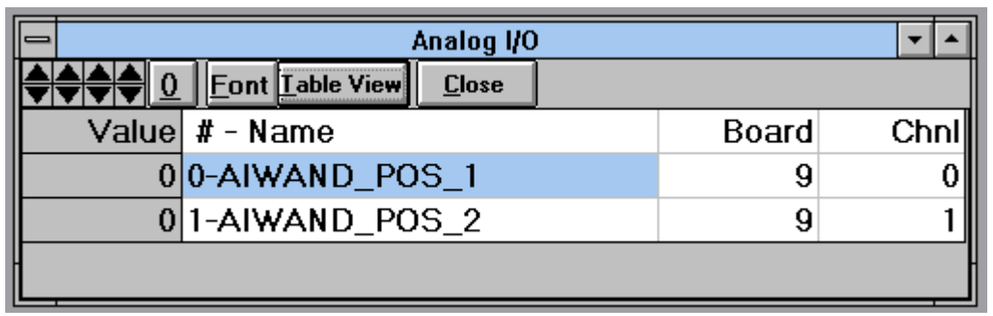

Figure 4-6. C2C Analog I/O Window

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C2C Analog I/O Window, continued

C2C Analog I/O Window Controls

Refer to Figure 4-5 to see the location of the C2C Analog I/O window buttons and controls.

Table 4-7. C2C Analog I/O Window Controls

Button Name	Description
0	Resets the highlighted output values to zero.
Font	Enlarges the font size of the table for easier viewing.
Table View	This key allows maintenance to display the auto scaling feature. The RUN version of OnGaard© does not include this capability.
Close	Closes the C2C Analog I/O window.
Arrow Keys	Changes the flow, pressure, and speed values.

NOTE: **The two values shown in the C2C Analog I/O window are inputs and cannot be changed, only viewed.**

MP Service Mode

MP Service Elements

The MP Service Mode screens allow access to the I/O's for all the systems controlled / coordinated by the MP computer systems. The discrete (digital) I/O values can be read or changed from the MP Discrete I/O Window. The Analog I/O values can be viewed in the MP Analog I/O Window. The MP Task List will run stand-alone routines.

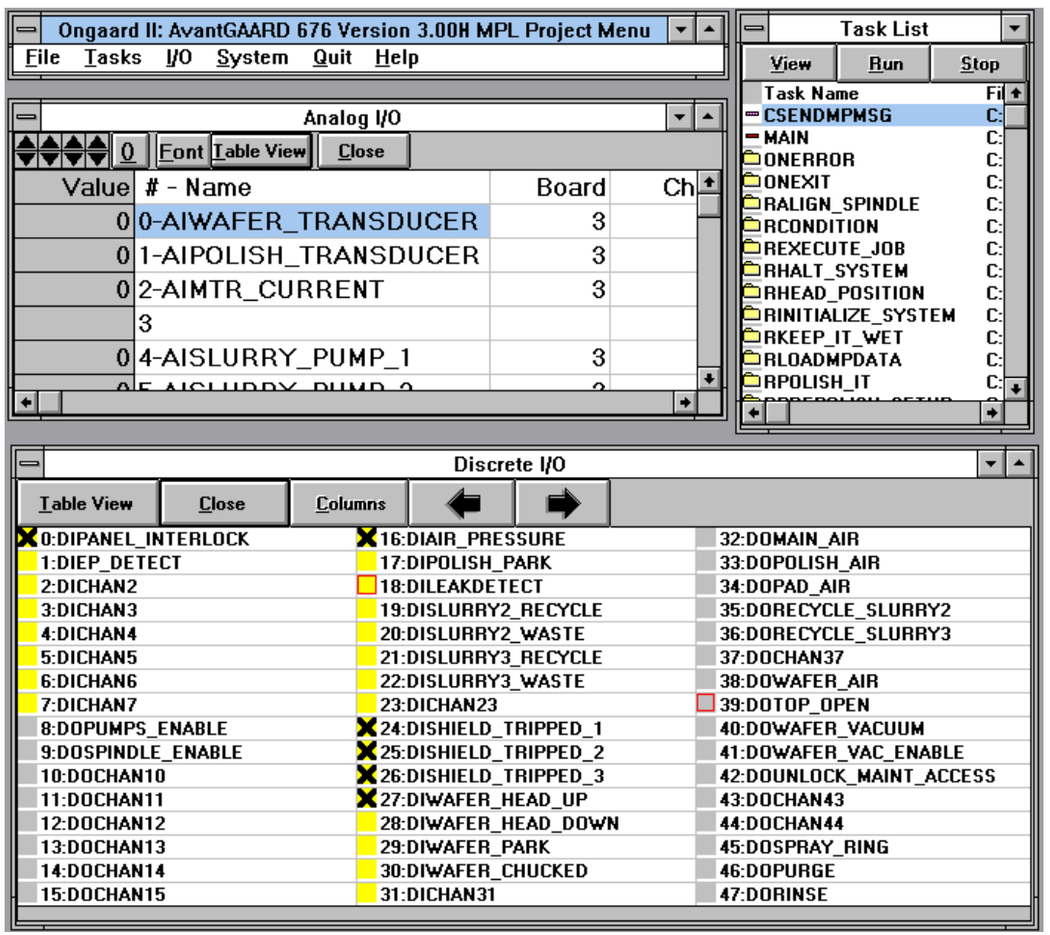

Figure 4-7. MP Service Elements

MPL Project Menu

MPL Project Menu Window

Table 4-8 gives descriptions of the menu options in the MPL Project Menu window.

Figure 4-8. MPL Project Menu Window

Menu Options

Table 4-8. MPL Project Menu Options

Menu Choice	Description
File	Not used in the RUN version.
Tasks	The Run Main Task option is the only option that should be used. This option will display the Control menu bar. This is the same bar seen when running in Production Mode.
I/O	Selects which I/O function windows will be displayed. The MP uses analog and discrete for this software release. The reset I/O returns values to their initialization states. Checking “Network” will display the network mail addresses for the systems that report to the MP.
System	Selecting “Task Status” will display the task list. Selecting the “Messages” will display the window that gives messages concerning the status of the system. Messages are stored in the order in which they are received. Selecting “Variables” will display the Global Variables list.
Quit	Closes the active windows and exits the program.
Help	Help files are not available at this time.

MPL Task List

MP Task List

Tasks displayed in the MP Task List window are programs or sub-routines that the MP runs during operations. Table 4-9 lists the task list titles for the MP Task List window. Refer to Figure 4-9 to see the location of the MP Task List window tasks.

Table 4-9. MP Task List Key

Nomenclature	Description
R...	Tasks that start with an R are Runable - the task will only run, it cannot be changed.
C...	Tasks that start with a C are Callable - the task will be called by other sub-routines during a run, it cannot be changed.
Main and Onexit	These tasks run during start-up and shut-down respectively. Main runs the re-initialization, and Onexit is used to clean-up the system at shut-down.

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MPL Task List, continued

MP Task List Window

Refer to Table 4-9 for an explanation of the MP Task List window tasks. Refer to Table 4-10 for an explanation of the MP Task List window buttons and controls.

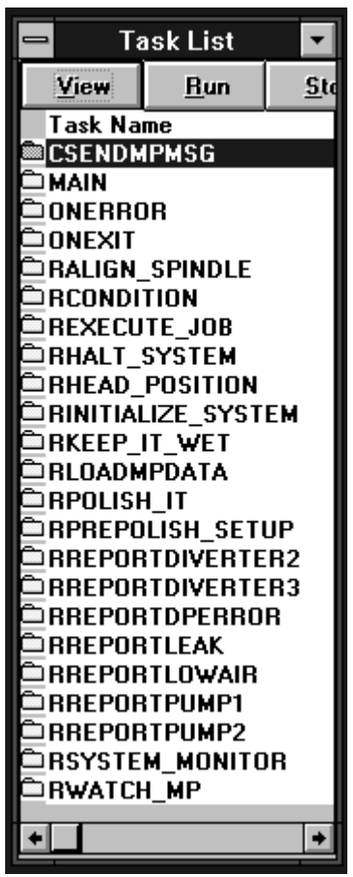

Figure 4-9. MP Task List Window

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MPL Task List, continued

Controls

Refer to Figure 4-9 for the location of the MP Task List window controls.

WARNING - MAKE SURE ALL PERSONNEL STAY A SAFE DISTANCE FROM THE TOOL WHEN IT IS IN SERVICE MODE. SERVICE MODE OPERATIONS EXPOSE PERSONNEL TO INCREASED RISKS AND MECHANICAL HAZARDS. THE TOOL WILL DO ANY COMMAND GIVEN, REGARDLESS OF THE CONDITION OF THE TOOL COMPONENTS OR ASSEMBLIES. DAMAGE TO PERSONNEL, EQUIPMENT, OR PRODUCT IS POSSIBLE UNTIL THE TOOL IS NO LONGER IN SERVICE MODE.

Table 4-10. MP Task List Buttons

Nomenclature	Description
View	Allows single stepping through the selected task. An “eye” icon will appear next to the folder when selected. Single step through the program using Step (the current line number is displayed) or allow the Tool to complete the program by selecting Stop Step. Only use Stop Step if you are sure of what Tool activities the code will do. If Skip Step is used, BE AWARE of the steps you are skipping. It is possible to skip steps that can cause severe damage to the Tool.
Run	Starts the highlighted task.
Stop	Ends the highlighted task.

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MPL Task List, continued

NOTE: **Highlighting a running task and pushing the <ESC> key will halt the process immediately. When a task is running, a red plus sign will appear in the place of the folder icon. When a task has completed running a red minus sign will appear in the place of the folder icon. If a task has an error in it, a red circle will appear in the place of the folder icon.**
If a red circle appears, call a SpeedFam-IPEC service technician or SpeedFam-IPEC.

MP Discrete I/O Window

MP Discrete I/O Window

The MP Discrete I/O window displays the channel numbers the computer addresses, and the function that channel operates or reads. It is possible to change the outputs, or read the value of the inputs, from this screen. Refer to Table 4-11 for a description of the MP Discrete I/O window controls. Refer to Appendix B for a complete list of the MP Discrete I/Os.

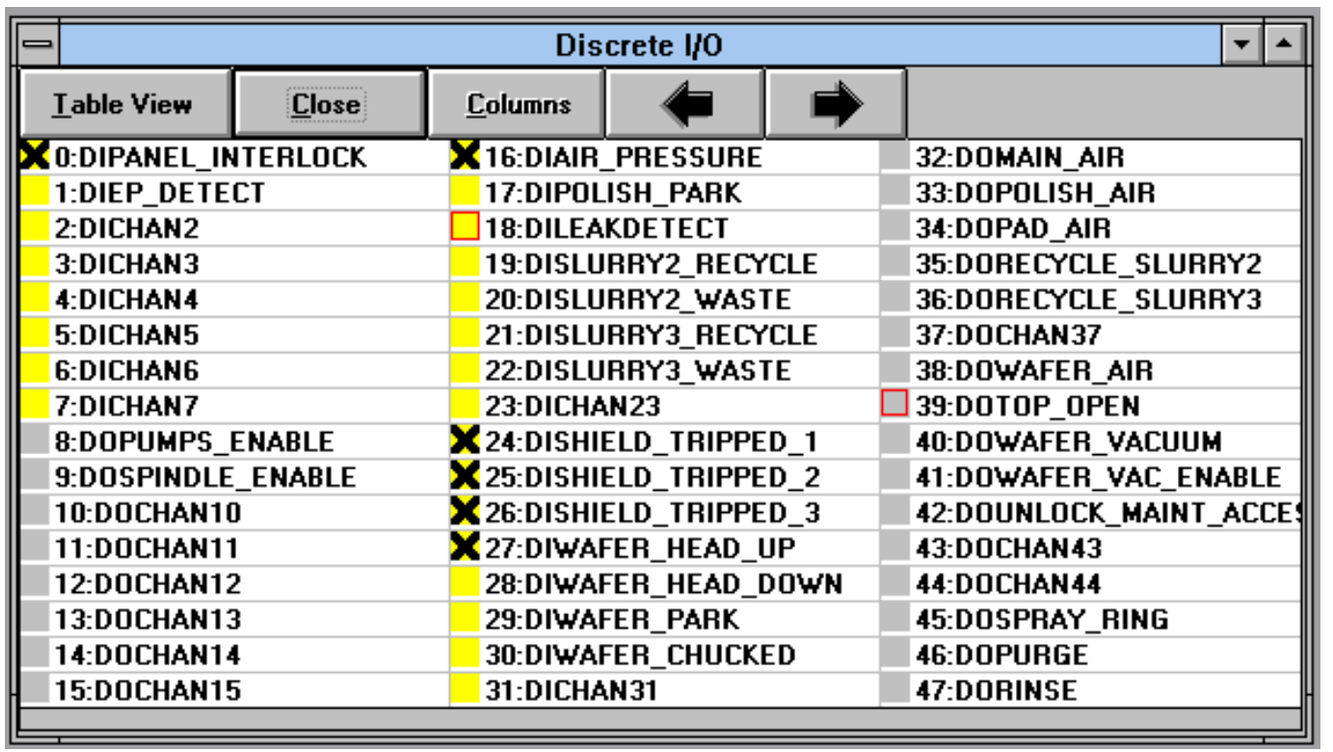

Figure 4-10. MP Discrete I/O Window

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MP Discrete I/O Window, continued

Controls

Refer to Figure 4-10 to see the location of the MP Discrete I/O window buttons and controls.

Table 4-11. MP Discrete I/O Window Controls

Button Name	Description
Table View	Allows the channel numbers to be redefined and all functions locked out.
Close	Closes the MP Discrete I/O window.
Columns	Allows the default of 3 columns of I/O viewing at a time to cycle and can be expanded to a maximum of 9 columns.
Arrow Keys	The large arrow keys at the top of the screen allow you to scroll through the table when it is listed by name.

NOTE:

Inputs and outputs are referenced from the computers point of view. An input is a signal going into the computer from the system, and an output is a signal going from the computer to the system.

Inputs are shaded Yellow, outputs are Gray. An “x” indicates that the I/O is active.

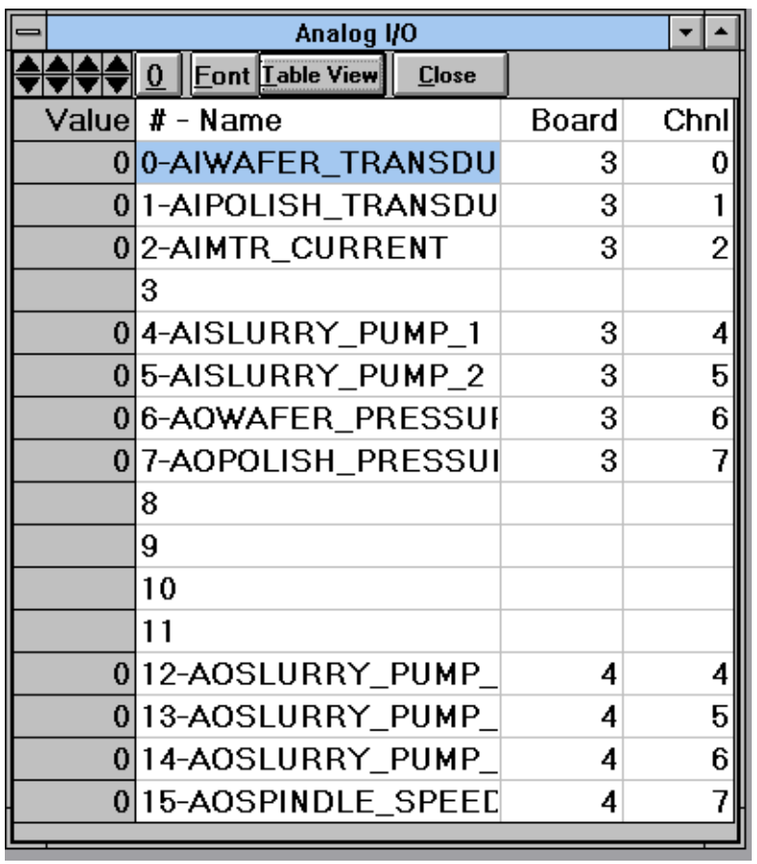
It is necessary to double-click on any output that you wish to activate or de-activate.

Change conditions by double-clicking on the output to change. The width of the MP Discrete I/O window can be changed, if required, to read the titles more clearly.

MP Analog I/O Window

MP Analog I/O Window

The MP Analog I/O window displays the readings from the P/I transducers that are inputs to the computer, and the drive signals to the motor controllers and the E/P regulators that are outputs from the computer. Slurry pump flow rates are also set and read in through the Analog I/O window. Refer to Table 4-12 for a description of the MP Analog I/O window controls. Refer to Appendix B for a complete list of the MP Analog I/Os.



Value	# - Name	Board	Chnl
0	0-AIWAFER_TRANSDU	3	0
0	1-AIPOLISH_TRANSDU	3	1
0	2-AIMTR_CURRENT	3	2
	3		
0	4-AISLURRY_PUMP_1	3	4
0	5-AISLURRY_PUMP_2	3	5
0	6-AOWAFER_PRESSUI	3	6
0	7-AOPOLISH_PRESSUI	3	7
	8		
	9		
	10		
	11		
0	12-AOSLURRY_PUMP_	4	4
0	13-AOSLURRY_PUMP_	4	5
0	14-AOSLURRY_PUMP_	4	6
0	15-AOSPINDLE_SPEEI	4	7

Figure 4-11. MP Analog I/O Window

continued on next page

MP Analog I/O Window, continued

MP Analog I/O Window Controls

Refer to Figure 4-11 to see the location of the MP Analog I/O window buttons and controls.

Table 4-12. MP Analog I/O Window Controls

Button Name	Description
0	Resets the highlighted output values to zero.
Font	Enlarges the font size of the table for easier viewing.
Table View	This key allows maintenance to display the auto scaling feature. The RUN version of OnGaard© does not include this capability.
Close	Closes the MP Discrete I/O window.
Arrow Keys	Changes the flow, pressure, and speed values.

continued on next page

MP Analog I/O Window, continued

NOTE: **Values can be changed by double clicking on the value box and changing the number in the "ANALOG CHANNEL" window that appears, or by using the arrow keys.**

Inputs and outputs are referenced from the computers point of view. An input is a signal going into the computer from the system, and an output is a signal going from the computer to the system.

Pressures are measured in thousandths of psi (for example, DAC 1500 = 1.5 psi). The upper allowable limit is 14000 or 14.000 psi. Use Caution or damage to the equipment is possible by over pressurizing the bladders. Always pressurize the polish head before the wafer head. If the wafer head is up, do not exceed 1 psi.

Slurry pump outputs are measured in ml/min (for example, DAC 145 = 145 ml/min. flow). The limit for pump 1 is 300 ml/min and pumps 2 and 3 are 200 ml/min.

Spindle speed is measured in tenths of rpm (for example, DAC 300 = 30 rpm). The limit is DAC 3400 or 340 rpm.

MPL Control Menu

Overview The MPL Control Menu window is displayed when the Tool is running in Production Mode. It is also displayed whenever the Run Main Task is selected from Service Mode.

Figure 4-12. MPL Control Menu Bar

Chapter 5
Pneumatics

Contents This chapter contains the following topics:

Topic	See Page
MP Upper Pneumatic Panel Assembly	5-2
MP Lower Pneumatic Panel Assembly	5-7
C2C Upper Pneumatic Panel Assembly	5-10
C2C Lower Pneumatic Panel Assembly	5-13
Closed-Loop Delta-P Upgrade	5-17

MP Upper Pneumatic Panel Assembly

Component Descriptions

Table 5-1. MP Upper Pneumatic Panel Assy Components

Item	Description
E/P Regulator	Applies wafer pressure during polishing. Regulated to 25 psi for 1-15 psi output to the wafer head depending on software control. Input between 0-10 volts.
E/P Regulator Valve	Valve used to set E/P Regulator input of 25 psi. Value is displayed on E/P air gauge on the bottom of the regulator.
P/I Transducer (Transcoil)	[Open Loop System Only] Measures actual wafer pressure delivered by the E/P regulator during polishing. Input of 0 - 15 psi with 4 - 20 mA output. This is strictly a sensor - it reports directly to the computer in an open loop.
Delta-P P/I Transducer	[Closed Loop System Only] Measures the pressure difference between the wafer and polish heads during polish.
Piab Trap (Slurry Mist Separator)	Filter or trap used to capture any slurry that is pulled into the vacuum lines from the wafer head.
Piloted Check Valve	Also referred to as the “head lock” valve, it prevents the wafer head from lowering if air or power are removed from the Tool.

continued on next page

MP Upper Pneumatic Panel Assembly, continued

Item	Description
Cylinder Flow Control Valve	Controls the vertical speed of the wafer head by adjusting the level of exhaust flowing from the cylinder. Should be adjusted to take 5 seconds to travel from top to bottom. If the valve is closed when the head comes down, the line can “blow up.”
Top Open Valve	Also known as the “head up” valve. Switches air to raise and lower the wafer head. Solenoid M039.
Vacuum Sensor	Senses and reports the level of vacuum being pulled through the wafer head. Specified reading should be 63 cm Hg at sea level with a wafer chucked, anything less indicates a problem. Set the sensor to trip at 55 cm Hg as a minimum.

continued on next page

MP Upper Pneumatic Panel Assembly, continued

Item	Description
Wafer Speed (Park) Sensor	Sensor is powered on and will trigger when the drive collar is in the park position.
Turck Sensor Block	Sensor connection manifold where all panel sensors are connected for routing to the Cross Connect Boxes.
Valve Manifold	24VDC Solenoid valves for: M042- Unlock for maintenance access doors M043- undefined M044- undefined
Wafer Vacuum Valve	Switch to enable and disable wafer head vacuum. 24VDC solenoid M040.
Wafer Vacuum Enable Valve	Switch that enables vacuum to be generated by allowing air flow through the vacuum generator. 24V DC solenoid M041
Vacuum Generator	Creates vacuum for the system. Vacuum is generated as a result of air flow past an open port.
Wafer Air Valve	Switch to enable air pressure to the wafer head. It is used to unseat the wafer after polishing, leaving the wafer face down on the polish pad. 24V DC solenoid M038.

continued on next page

MP Upper Pneumatic Panel Assembly, continued

Panel Layout and Line Flow

Refer to the drawings and schematics in Appendix E when reviewing the layout and line flow of the MP Upper Pneumatic panel assembly.

Tubing Colors

The following list identifies colors of the tubing used on the MP Upper Pneumatic panel assembly:

- Green = Exhaust
- Blue = Switched Air
- Red = Unswitched Air
- Orange = Wafer Air
- Yellow = Vacuum
- Black = Top Cylinder Air
- Gray = Device Air

continued on next page

MP Upper Pneumatic Panel Assembly, continued

Service I/O's

Service Mode I/Os are used when working on the pneumatic systems of the MP. The following is a list of the I/O's associated with the MP Upper Pneumatic panel assembly.

Table 5-2. Service I/O's

Channel	Input/Output	Name
Ch. 9	DO	SPINDLE_ENABLE (digital)
Ch. 27	DI	WAFER_HEAD_UP (digital)
Ch. 28	DI	WAFER_HEAD_DOWN (digital)
Ch. 29	DI	WAFER_SPEED (digital) (Park Sensor)
Ch. 30	DI	WAFER_CHUCKED (digital)
Ch. 38	DO	WAFER_AIR (digital)
Ch. 39	DO	TOP_OPEN (digital)
Ch. 40	DO	WAFER_VACUUM (digital)
Ch. 41	DO	WAFER_VAC_ENABLE (digital)
Ch. 42	DO	UNLOCK_MAINT_ACCESS (digital)
Ch. 0 (Rack 3)	AI	WAFER_TRANSDUCER (analog)
Ch. 6 (Rack 3)	AO	WAFER_PRESSURE (analog)
Ch. 7 (Rack 4)	AO	SPINDLE_SPEED (analog)

continued on next page

MP Upper Pneumatic Panel Assembly, continued

Solenoid Check	If a bad solenoid is suspected, make sure it is installed correctly Most problems with a solenoid occur because it has not been tightened properly and air is escaping around the gasket between the solenoid and the valve. Very rarely does a solenoid go bad. They are usually replaced when the valve itself goes bad. If the solenoid / valve has unswitched air connected to it, you must position the OFA valve to OFF where it enters the Tool before removing the hoses.
Head Up Valve Information	The head up valve makes the wafer head go up and works with pilot check valve to keep head from coming down when main air is switched OFF. Removing electrical power will cause the head to travel up. A softstop will cause the head to go up. When energized, the valve applies air to the top of the head and also to piloted check valve to allow air to bleed from the bottom of head.

MP Lower Pneumatic Panel Assembly

Component Descriptions

Table 5-3. MP Lower Pneumatic Panel Assy Components

Item	Description
E/P Regulator	Applies polish pressure during polishing. Regulated to 25 psi for 1-15 psi output to the polish head depending on software control. Input between 0-10 volts.
P/I Transducer (Transcoil)	[Open Loop System Only] Measures actual polish pressure delivered by the E/P regulator during polishing. Input of 0 - 15 psi with 4 - 20 mA output. This is strictly a sensor - it reports to the computer in an open loop.
Delta-P P/I Transducer	[Closed Loop System Only] Measures polish pressure and sends a feedback signal to the Delta-P Transducer in the MP Upper Pneumatic panel assembly which will then adjust the wafer pressure to correct any Delta-P problems.
E/P Regulator Valve	Valve used to set E/P Regulator input of 25 psi. The value is displayed on E/P air gauge on the front edge of the panel assembly.
Pad Air Valve	[Open Loop System Only] Enables and disables pad air. Pad air is the pressure sent through the pad to dislodge the wafer after polishing. Uses solenoid M034. Also blows DI water out from under the head.
Pad Air Regulator	[Open Loop System Only] Regulates air flow through the pad air valve.

continued on next page

MP Lower Pneumatic Panel Assembly, continued

Item	Description
Main Air Filter Regulator	The main air regulator and filter for incoming OFA. Air is regulated to 85 ±5psi.
Main Air Valve	Valve to provide main air to individual MP components using switched air. Receives incoming OFA. Solenoid M032.
Pressure Sensor	[Open Loop System Only] Sensor to monitor pressure from main air filter regulator. Set to 85 ± 5psi.
Polish Air Valve	Valve to apply or position polish air to the head during a polish cycle to OFF. Solenoid M033.
Valve Manifold	Solenoid valves for: • M035- Recycle slurry 2 • M036- Recycle slurry 3 • M037-Spare
Pad Filters	Filter to catch slurry or DI water that may flow back into the lines from the polish head.

continued on next page

MP Lower Pneumatic Panel Assembly, continued

Panel Layout and Line Flow

Refer to the drawings and schematics in Appendix E when reviewing the layout and line flow of the MP Lower MP Pneumatic panel assembly.

Tubing Colors

The following list identifies the tubing used on the MP Lower Pneumatic panel assembly:

- White = Polish Air
- Purple = Pad Air
- Blue = Switched Air
- Red = Unswitched Air
- Green = Exhaust

Service I/O's

Table 5-4. Service I/O's

Channel	Input/Output	Name
Ch. 16	DI	AIR_PRESSURE (digital)
Ch. 17	DI	POLISH_PARK (digital)
Ch. 32	DO	MAIN_AIR (digital)
Ch. 33	DO	POLISH_AIR (digital)
Ch. 34	DO	PAD_AIR (digital)
Ch. 1 (Rack 3)	AI	POLISH_TRANSDUCER (analog)
Ch. 7 (Rack 3)	AO	POLISH_PRESSURE (analog)
Ch. 7 (Rack 4)	AO	SPINDLE_SPEED (analog)

C2C Upper Pneumatic Panel Assembly

Component Descriptions

Table 5-5. C2C Upper Pneumatic Panel Assy Components

Item	Description
Vacuum Sensors (1 & 2)	Senses and reports the level of vacuum being pulled through the robot wand vacuum channels. Specified reading should be 63 c Hg at sea level with a wafer on the wand.
Sensor Array Check Valve	Also referred to as the “array up” valve, it prevents the wafer sensor array combs from lowering if air and power are removed from the Tool.
Paddle Air Valve (1 & 2)	Mac valves that enable paddle air to flow through channel 1 or 2 on the robot wand.
Paddle Vacuum Enable Valve (1 & 2)	Mac valves that enable vacuum to be generated by allowing air flow through the vacuum generators.
Vacuum Generators (1 & 2)	Creates vacuum for each channel of the robot wand. Vacuum is generated as a result of air flow past an open port.
Flow Control Valve	Controls the vertical speed of the operator door by adjusting the level of exhaust flowing from the cylinder.

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C2C Upper Pneumatic Panel Assembly, continued

Item	Description
Paddle Air (1 & 2) Regulator	Valve used to set paddle air output of both channels to 0.5 psi
Turck Sensor Block	Sensor connection block where all panel assembly sensors are connected for routing to the Electrical Cabinet.
Valve Manifold	24V DC Solenoid valves for: • C073- Lower sensor array 1 • C074- Lower sensor array 2 • C075- Open cassette door • C076- Spare

continued on next page

C2C Upper Pneumatic Panel Assembly, continued

Panel Layout and Line Flow

Refer to the drawings and schematics in Appendix E when reviewing the layout and line flow of the C2C Upper Pneumatic panel assembly.

Tubing Colors

The following list identifies the tubing used on the C2C Upper Pneumatic panel assembly:

- Gray = Device Air
- Red = Unswitched Air
- Green = Exhaust
- Blue = Switched Air
- Yellow = Vacuum
- White = Paddle Air

Service I/O's

Service Mode I/Os are used when working on the pneumatic systems of the C2C. The following is a list of the I/O's associated with the C2C Upper Pneumatic panel assembly. (All of these are digital)

continued on next page

C2C Upper Pneumatic Panel Assembly, continued

Table 5-6. Service I/O's

Channel	Input/Output	Name
Ch. 13	DI	OPERATOR_DOOR_UP
Ch. 14	DI	OPERATOR_DOOR_DOWN
Ch. 42	DI	SENSOR_ARRAY_1_UP
Ch. 43	DI	SENSOR_ARRAY_1_DOWN
Ch. 44	DI	SENSOR_ARRAY_2_UP
Ch. 45	DI	SENSOR_ARRAY_2_DOWN
Ch. 46	DI	PADDLE_VAC_SW_1

continued on next page

C2C Upper Pneumatic Panel Assembly, continued

Channel	Input/Output	Name
Ch. 47	DI	PADDLE_VAC_SW_2
Ch. 69	DO	PADDLE_VAC_1
Ch. 70	DO	PADDLE_AIR_1
Ch. 71	DO	PADDLE_VAC_2
Ch. 72	DO	PADDLE_AIR_2
Ch. 73	DO	LOWER_SENSOR_ARRAY_1
Ch. 74	DO	LOWER_SENSOR_ARRAY_2
Ch. 75	DO	CLOSE_OPERATOR_DOOR
Ch. 78	DO	SENSOR_ARRAY_2_SELECT

C2C Lower Pneumatic Panel Assembly

Component Descriptions

Table 5-7. C2C Lower Pneumatic Panel Assy Components

Item	Description
Main Air Valve	Valve to provide main air to all machine components using switched air. Receives unswitched OFA. Solenoid C048.
Main Air Filter Regulator	The main air regulator and filter for incoming C2C OFA. Air is regulated to 85 ±5psi.
Valve Manifold (Top)	24V DC Solenoid valves for: (all Digital Output) C049- Cassette 1 fast fill C050- Cassette 1 fast dump C051- Cassette 2 fast fill C052- Cassette 2 fast dump C053- Raise cassette 1 C054- Rotate cassette 1 C055- Raise cassette 2 C056- Rotate cassette 2

continued on next page

C2C Lower Pneumatic Panel Assembly, continued

Item	Description
Valve Manifold (Bottom)	24V DC Solenoid valves for: (all Digital Output) C057- Quick dump 1 C058- Quick dump 2 C059- Spare C060- Spare P096- Lower arm 1 P097- Micro spray 1 P0128- Lower arm 2 P0129- Micro spray 2
Oxide Pad Conditioner Regulator Valves and Gauge	Used to regulate pressure to the Pad Conditioner bladders. Set to 2 PSI.

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C2C Lower Pneumatic Panel Assembly, continued

Panel Layout and Line Flow

Refer to the drawings and schematics in Appendix E when reviewing the layout and line flow of the C2C Lower Pneumatic panel assembly.

Tubing Colors

The following list identifies the tubing used on the C2C Lower pneumatic panel assembly:

- Gray = Device OFA
- Blue = Switched OFA
- Red = Main OFA
- Green = Exhaust

continued on next page

C2C Lower Pneumatic Panel Assembly, continued

Service I/O's

Service Mode I/Os are used when working on the pneumatic systems of the C2C. The following is a list of the I/O's associated with the C2C Lower Pneumatic panel assembly. (All of these are digital.)

Table 5-8. Service I/O's

Channel	Input/Output	Name
Ch. 2	DI	CASSETTE_1_UP
Ch. 3	DI	CASSETTE_1_DOWN
Ch. 4	DI	CASSETTE_1_IN_PLACE
Ch. 5	DI	CASSETTE_1_LOAD
Ch. 6	DI	CASSETTE_1_OPERATION
Ch. 7	DI	CASSETTE_2_UP
Ch. 8	DI	CASSETTE_2_DOWN
Ch. 9	DI	CASSETTE_2_IN_PLACE
Ch. 10	DI	CASSETTE_2_LOAD
Ch. 11	DI	CASSETTE_2_OPERATION
Ch. 48	DO	MAIN_AIR
Ch. 50	DO	CASSETTE_1_FD
Ch. 52	DO	CASSETTE_2_FD
Ch. 53	DO	RAISE_CASSETTE_1

continued on next page

C2C Lower Pneumatic Panel Assembly, continued

Channel	Input/Output	Name
Ch. 54	DO	ROTATE_CASSETTE_1
Ch. 55	DO	RAISE_CASSETTE_2
Ch. 56	DO	ROTATE_CASSETTE_2
Ch. 57	DO	QUICK_DUMP_1
Ch. 58	DO	QUICK_DUMP_2

Closed-Loop Delta-P Upgrade

Introduction In the original design, the polish and wafer pressures are “open-loop” commands. The E/P Regulators are commanded to a particular pressure setpoint based on the recipe. The P/I Transducers are not used to close the loop and adjust the commanded pressure to correct for any errors. Both wafer and polish pressures are read from independent gauge transducers, where the Delta-P reading is a difference of the measured gauge readings. Any mis-calibration, pressure line losses, or leaks may result in inaccurate pressures at the wafer and polish pads, resulting in lower process performance and possible wafer breakage.

To improve process stability, a closed loop pressure control system that regulates polish pressure as well as Delta-P was added as a option on the 676.

Function This system uses a Proportional-Integral-Derivative (PID) controller to track the measured polish pressure and adjusts the wafer pressure accordingly to maintain the Delta-P setpoint. The new P/I pressure transducers are feedback signals for two closed loop controllers. The first controller is for Delta-P, which was to replace the wafer P/I with a differential pressure transducer. This measures Delta-P pressure directly. The second controller is to close the loop on polish bell pressure. The Delta-P P/I Pressure Transducer measures negative Delta-P, (WaferPressure - PolishPressure), rather than (PolishPressure - WaferPressure) used in the conventional MP configuration.

The wafer P/I transducer (in Tools with no closed loop Delta-P control system installed), or the Delta-P P/I transducer (in Tools with a closed loop pressure control system installed) are both referred to as aiUpper_Transducer in the Analog I/O screen.

aiWafer_Transducer -----becomes----> aiUpper_Transducer(conventional MP configuration)
aiDelltaP_Transducer ----becomes----> aiUpper_Transducer(closed loop Delta-P MP config)

continued on next page

Closed-Loop Delta-P Upgrade, continued

Components

The major Delta-P components are the MP Upper Pneumatic Panel Assembly and MP Lower Pneumatic Panel Assembly.

Installation

Installation of hardware and software is required for the Delta-P upgrade. Contact SpeedFam-IPEC for 24 hour Technical Support at 1-800-WSI-KARE.

continued on next page

Closed-Loop Delta-P Upgrade, continued

Accessing PIDs

The PIDs can be accessed for testing and troubleshooting while in Service Mode from the OnGaard© PID service menu as shown in Figure 5-1.

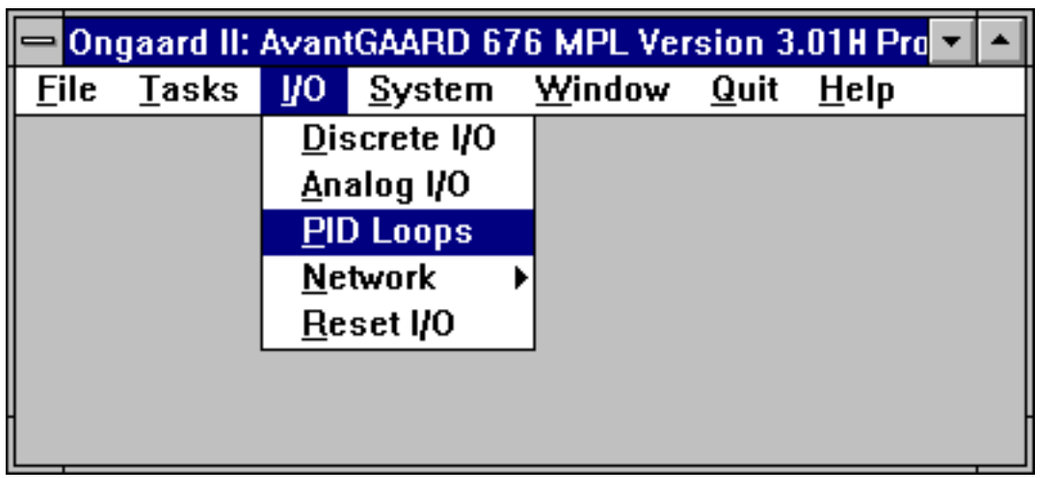

Figure 5-1. PID Control Menu

Closed-Loop Delta-P Upgrade, continued

Software Calibration	Do Calibration and Alignment procedure, “Closed Loop Delta P Calibration” on page 14-52.
Testing	Do Monthly Preventive Maintenance procedure, “Delta-P Performance Test” on page 12-79.
Trouble-shooting	Refer to “Troubleshooting the Delta-P System” on page 11-13.

Chapter 6

Head Assemblies

Contents This chapter contains the following topics:

Topic	See Page
Wafer Head Assembly	6-3
Polish Head Assembly	6-5
Advanced Pad Motion (APM) Option	6-8
Brookside Endpoint Detection System	6-33
Luxtron Endpoint Detection System	6-34
F76 Endpoint Detection System	6-37

Wafer and Polish Head Assemblies

Description The head assemblies do the “work” of the AvantGaard™ 676 polishing process. As with the pneumatic panels, servicing the head assemblies encompasses a large percentage of troubleshooting, corrective, and preventive maintenance procedures. Refer to Wafer Head Assembly Lower for a complete visual breakdown of the Wafer Head components. Refer to Polish Head Assembly Upper for a complete visual breakdown of the Polish Head components.

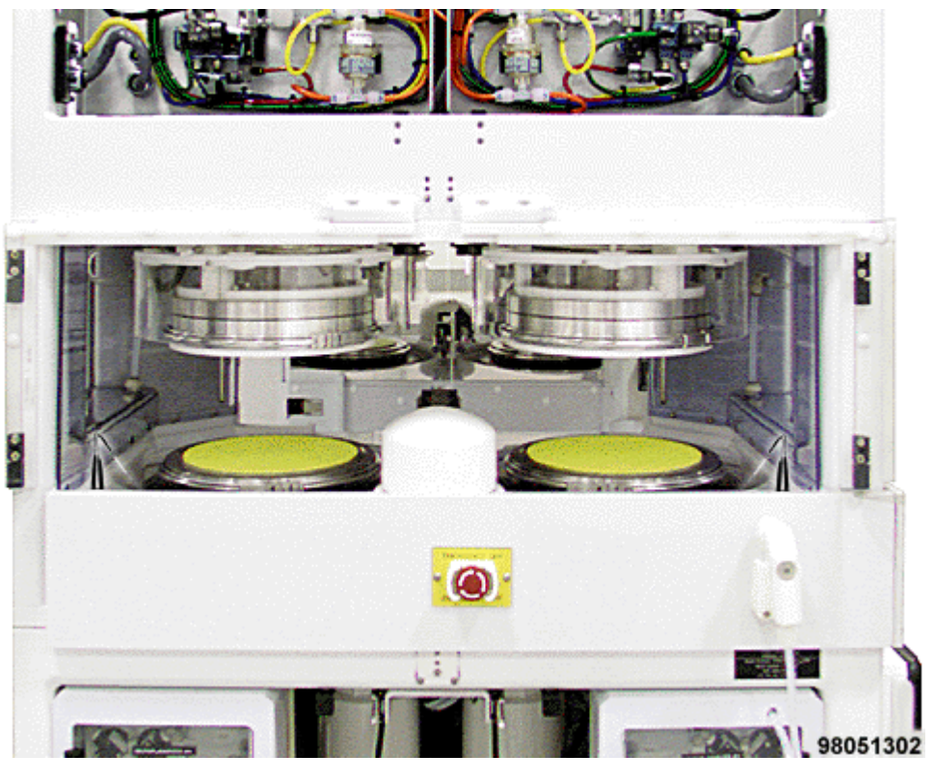

Figure 6-1. Head Assemblies

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Wafer Head Assembly

Component Descriptions

Table 6-1. Wafer Head Assembly Components

Item	Description
Carrier Plate O-Rings	Sea between wafer carrier and carrier mount, and between the wafer center and the diaphragm.
DF 200 (Wafer Backing Pad)	Attaches to wafer backing plate as a cushion for the wafer.
Diaphragm	Seal between wafer backing plate, wafer carrier plate, and wear ring.
Drive Collar	Couples rotary motion of shaft to wafer carrier mount.
Kaydon Bearing	Slip surface for the assembly. The wafer head bell remains stationary while the wafer carrier head mount rotates, the Kaydon bearing allows slip between these two components.
Snap Ring	Keeps shaft from falling out of the carrier assembly
Top Clamp O-Ring	Sealing surface between top clamp ring and wafer carrier mount. This is also a sealing surface between ring and waferhead bell.
Wafer Head Bearing Clamp Ring	Mounting surface for wafer assembly.
Wafer Carrier Mount	Rotating assembly coupled to wafer head bell through a bearing. Surface that the wafer carrier assembly is attached to with a V-band clamp.

continued on next page

Wafer Head Assembly, continued

Item	Description
Wafer Carrier Plate	Large stainless steel ring that attaches to wafer carrier mount with V-band clamp.
Wafer Backing Plate Retaining Ring	Mounting surface for wafer diaphragm and wafer backing plate.
Wafer Head Bell	Main attachment piece for assembly, this part remains stationary.
Wear Ring	Forms the recess that holds the wafer during the polish process.

Polish Head Assembly

Component Descriptions

Table 6-2. Polish Head Assembly Components

Item	Description
Polish Bell	Carrier and conduit for all process fluid tubing and fittings Carrier for polish bladder, mesh, upper / lower V-band clamp ring, polish pad, V-band clamp, and labyrinth seal skirt.
Inside Bearing Clamp Ring	The polish bell funnel and upper bearing inner race located on this ring.
Wave Generator	The device that translates circular motion into a wave pattern.
Drive Spool	Attachment point for drive pulleys. Couples torque from motor to polish head assembly.
V-Band Clamp Upper Ring	Drops down over top of polish pad assembly and gives a solid flat surface for polish pad assembly. This ring attaches to the lower clamp ring.
V-Band Clamp Lower Ring	Mechanically couples to polish bell. Follows motion of polish bell and gives a flat surface for polish pad assembly.
V-Band Clamp	Couples upper and lower ring to each other and gives a solid mounting for polish pad.
Slurry Diaphragm	A flexible barrier whose shape changes as polish air pressure is applied. Does not allow air to escape. Pressure remains constant, which applies pressure to pad and contours the pad for polishing.

continued on next page

Polish Head Assembly, continued

Item	Description
Slurry Mesh	A type of “manifold.” It distributes fluids evenly across top of diaphragm.
Polish Bell O-Ring	Compression surface between lower V-band clamp ring and polish bell. Prevents slurry and rinse water from escaping.
Kaydon Bearing	Allows wave generator and polish bell assembly to slip by each other and motion to be created.
Polish Pad Assembly	Mechanical polishing surface. The assembly includes the polish diaphragm, pad backing, and polish pad.
Diaphragm O-Ring	Seals polish pad assembly from leaking slurry or rinse water.
Hose Funnel	Protects hoses from being worn by rotating parts. In addition, it routes the hoses through the assembly.
Slinger	Forms labyrinth seal with polish bell skirt. Protects bearings from sprays and runoff.
Polish Bell Skirt	Directs runoff slurry away from head assembly.

continued on next page

Polish Head Assembly, continued

Precautions When Servicing

- Cut tubing to fit after installing fittings.
- All tubing must be below the surface of the polish bell when finished.
- Do not cut the Teflon® coating on the polish bell.
- Do not force fittings into threaded holes; they may seize in the polish bell. Remove and rework or discard fitting.
- Make sure that O-Rings are properly seated on fittings so that they will not be cut when installed.
- Do not position hose barbs over mounting holes.
- Keep the center of the polish bell clear for the tygon tube coil leading to the bladder fitting.
- Make sure all fittings are tight when maintenance procedures are completed.
- Use clean/dry compressed air to blow out all bulkhead fittings to remove any particles that may have been picked up on the bottom side of the polish bell.

Advanced Pad Motion (APM) Option

Description The Advanced Pad Motion (APM) option adds a rotational, oscillating motion, to the standard orbital motion of the polish head. The optional APM unit consists of minor software modifications and four APM assemblies.

Hardware for the APM is installed on each of the polish heads. The hardware is located directly below the polish head, mounted to the Tool base. Each APM unit consists of a stepper motor, a right angle 30-to-1 gearbox and shaft, a mechanical stop, a position sensor assembly, an IDC (Industrial Devices Corporation) SmartStep Controller, and a manual lockout screw.

Operation The rotational motion parameters are configured through the Tool software screens and can be used during wafer polishing or pad conditioning, or disabled when standard orbital polishing or conditioning is needed. The specific range and angular velocity of the APM are controlled through inputs in the polishing system recipe editor. This allows for maximum flexibility of the system during process development.

Advantages The main advantages of the APM option are:

- improved wafer non-uniformity due to the elimination or reduction of the high and low removal rate rings caused by the polish pad X-Y groove pattern
- reduction or elimination of inconsistent removal rate at the wafer center caused by pad orientation, wafer head to polish head offset, and zero rotational velocity of the wafer center
- reduction of center-to-edge non-uniformity caused by non-uniform pad conditioning

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Advanced Pad Motion (APM) Option, continued

Theory of Orbital Motion

On the 676 head configuration without APM, the polish bell is fixed so there is no rotational motion of the polish bell system. The two bearings in the wave generator permit the orbital motion to be separated from the rotational motion. The rotational motion seen across the frame, lower bearing, and wave generator system is converted to an orbital motion through the wave generator, upper bearing, and polish bell system. The offset of the center of the polish bell with respect to the center of the wave generator defines the orbit radius. The polish bell system does not allow rotational motion and is a pure orbital motion. This is achieved by hard mounting a drive shaft to both the polish bell and to the floor of the Tool. Although the drive shaft does not rotate, it does allow the 1.25 inch diameter orbit of the polish bell system. The upper and lower universal joints of the drive shaft allow the drive shaft to follow the motion while holding the polish bell from rotating to produce the purely orbital motion.

Polish Pad Rotational Oscillation

The Advanced Pad Motion option intentionally rotates the lower end of the drive shaft causing the polish bell system and polish pad to rotate through a specific range and angular velocity during wafer polishing. The range of rotational oscillation cannot exceed 360 degrees because the slurry supply and air supply lines would twist around the drive shaft. A motor and gear box with sufficient torque capability to counter the polishing torque are mounted to the floor of the Tool and fastened to the lower end of the drive shaft. The center axis of the output shaft of the APM mechanism must be co-linear with the axis of the center of spin of the wave generator. Deviation from co-linearity of the two subsystems will create a potential vibration source.

continued on next page

Advanced Pad Motion (APM) Option, continued

Polish Pad Rotational Oscillation During Polishing

A key process parameter improved with pad oscillation during polishing is non-uniformity. On 676 head configurations without APM, the removal rate of material across the wafer surface will vary, and non-uniformity can be worse depending on the orientation of the polish pad. Without APM, this specific problem is solved with critical pad orientation. The optimum placement of the polish pad is 22.5 degrees with a precise upper to lower head offset of 0.375 inches.

The X-Y grooves of the polish pad also adversely affect the non-uniformity of a polished wafer. This may be observed through the repeating patterns of concentric rings polished into the wafer from the orbital motion. Oscillating the polish pad about a center which is offset from the center of the carrier disrupts the pattern from forming on the wafer during polishing. In the same manner that “smearing” is obtained by rotating the carrier during polishing, “smearing” is improved further with pad oscillation during polishing.

Rotational Oscillation During Pad Conditioning

Uniform conditioning is important for obtaining low non-uniformity measurements along with consistent removal rates over large quantities of polished wafers. Pad oscillation during pad conditioning significantly increases the uniformity of pad conditioning. There are two regions, roughly perpendicular to the pad conditioner arm, that do not have contact with the pad conditioner. There is also a region of the polish pad, farthest away from the pivot of the conditioner arm, that conditions with higher velocities when compared to the region nearest the pivot of the conditioner arm.
Pad oscillation during pad conditioning moves the regions so the high velocity region rotates through the non-conditioning region and over to the low velocity region. Effectively, all areas of the pad are averaged through the different conditioning regions. This averaging effect due to pad oscillation increases the uniformity of the pad conditioning.

continued on next page

Advanced Pad Motion (APM) Option, continued

Mechanical Subsystem

Each APM unit consists of a stepper motor, gear box, output shaft, mounting plate, manual lockout screw, heat shield, and a hard stop with sensor array. This subsystem of the APM is a direct bolt-in replacement for the standard drive shaft base. Installation of these components on the 676 requires the standard base to be replaced by the mechanical subassembly. The slurry lines are removed from their current mounted position on the drive shaft. The multiple slurry and DI water lines branch into a single tube and then the single tube connects to the polish bell. The branched portion is relocated to the back of the slurry box. The tube connecting the branch to the polish bell is replaced with a longer tube to allow slack in the line. The slack is necessary to allow the rotational oscillation of the drive shaft. The air pressure supply and return tubes, and the DI water rinse lines, are relocated from the drive shaft to the back of the slurry box. For extra wear protection, a larger diameter section of tubing is slit and wrapped around the fluid lines along sections that are close to the drive shaft. The polish air accumulators are relocated from the drive shaft to the side of the APM gearbox.

Control Subsystem

The APM control system consists of the IDC (Industrial Devices Corporation) SmartStep Indexer and Controller located in a single small box. The IDC SmartStep controls the operation of the stepper motor. The Controller is connected to the MPs' computer through an RS232 cable. The cable is connected to the serial port of the computer (COM2). Parameters such as angular velocity and sweep range are commanded from the recipe in the SysCon screens, through the MPs computer, and passed down to the Controller. The IDC SmartStep is located on the pad conditioner high voltage panel assembly below the MP electronics modules. On the left side of the Electrical Cabinet, the MP 1 and 2 Controllers are located just below the MP2 electrical module. On the right side of the Electrical Cabinet, the MP 3 and 4 Controllers are located just below the MP4 electrical module.

continued on next page

Advanced Pad Motion (APM) Option, continued

Controller Connections

The IDC SmartStep Controller is connected to the mechanical subsystem by two cables. One cable powers the stepper motor, and the second cable connects the sensor array to the Controller. The sensor array has a home sensor, a clockwise limit sensor, and a counterclockwise limit sensor. The home sensor is used during individual MP initialization to give the Controller a home location, or origin, for the drive shaft. The limit sensors indicate to the Controller if the stepper motor tries to rotate the drive shaft at a greater range than was designed for the APM. A wedge is machined into the sensor array that is a hard stop if the limit sensors fail during operation. The wedge stops the motion of the stepper motor by causing the rotation of the output shaft to stop. The wedge is also the flagging mechanism for the three sensors indicating the rotational location of the drive shaft to the IDC SmartStep Controller.

The power source for the IDC SmartStep is the power supply for the inverter of the lower motor for the shared MP. This power source is already connected so that if a panel interlock is tripped, the power to the oscillator is removed, and all APM motion will stop. The interlock relay will have to be reset and the MP will have to be re initialized before polishing can be resumed.

Software Revision

A new version of software is installed with the implementation of the APM (software version 3.01M with APM Patch II is required). The software includes changes to the SysCon screens, including the Recipe Editor to include the angular velocity and range of motion inputs for pad conditioning and polishing. Different range and velocity parameters values can be used for pad conditioning and for polishing. The values for the two parameters can even be different for each pad conditioning step, if there are more than one.

continued on next page

Advanced Pad Motion (APM) Option, continued

Task files in the OnGaard program for each individual MP are affected by the change in software. A new task file called “poc.tsk” supports all logic and communication with the SmartStep controller. Other task files relating to polishing, conditioning, initialization, and system halt call various subroutines in the poc task file when APM operation is required. The APM unit is homed during the MP initialization sequence and includes a functional test of the positive and negative limit switches. If a limit switch fails, an alarm is generated, and the MP is halted. The polish and pad conditioner task files specify the parameter values of range and angular velocity, and activate the APM run command digital output accordingly. The APM software change also includes logic that aids in the diagnosis of problems of the APM unit if any problems occur during operation.

continued on next page

Advanced Pad Motion (APM) Option, continued

MP Computer Interface

A serial cable is connected between the communications port 2 on each MP computer and the IDC SmartStep Controller. The serial link is used to poll the Controller for status and set speed and range. To display the Serial I/O -Port dialog box (see Figure 6-2), select I/O => Serial I/O => SIDC. This dialog box displays any new commands sent to the serial device. As the Tool operates, the following commands will occasionally be sent to the SmartStep, “SS”, “SA1”, “SD1”, “RN1”, “EA1”, “VExx” and “(ENP)=xx” (“xx” indicates numeric values passed as part of the command). It is possible to manually send any of the SmartStep commands to the Controller using the Serial I/O dialog box. To enter commands the dialog box, the Tool must be in Manual Entry mode, by selecting CommPort menu option => Manual Entry. When the Tool is in Manual Entry mode, make the dialog box the active window by clicking the mouse inside the command area. Anything typed in the command area will then be sent to the Controller. The Enter key is used to send the Controller a command, and commands will not be processed until the Enter key is pressed. All SmartStep commands are case sensitive and must be capitalized to be recognized.

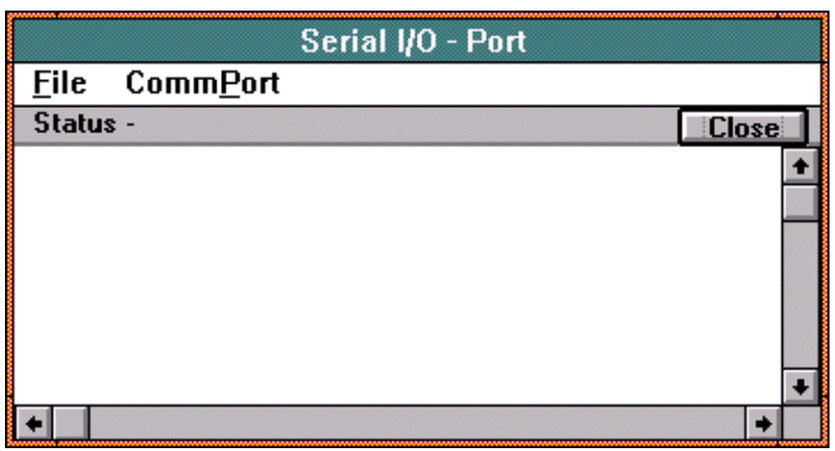

Figure 6-2. Serial I/O - Port Dialog Box

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Advanced Pad Motion (APM) Option, continued

Serial I/O Dialog Box

The Serial I/O - Port dialog box is used primarily for troubleshooting. Any legal SmartStep commands can be issued from the Serial I/O dialog box. For example, typing “RN1” followed by Enter will signal the Controller to run Program One. Status commands such as SS, SA1, and SD1 can also be issued from the I/O screen. Typing SS followed by Enter will send the System Status command to the SmartStep. A functioning Controller will respond with an asterisk (*) followed by a hexadecimal string, which represents the SmartStep status. S is used to halt the current operations of the SmartStep.

NOTE: **For more information on the Ongaard serial configuration, refer to the Ongaard II User manual.**

SERIAL.DAT

For the Ongaard to communicate through the serial port (channel), a serial.dat file must exist in the \..\setup directory. Use the “Settings” option under the “CommPort” menu to view the serial configuration parameters. The following entries are in a typical Serial.dat file:

Number: 1
UserName: SIDC
CommPort: 2
BaudRate: 9600
DataBits: 8
StopBits: 1
Parity: N
Timeout: 8000
InBufferSize: 2048
OutBufferSize: 2048
SendPrompt:
SendTerminator: D
SendAck1: D A 3E
SendAck2: D A 3E D A 3E
SendAck3: D A 3A
SendAck4: D A 3F
ClearBuffersOnWrite: Y
RcvPrompt: 2A
RcvTerm1: D
RcvTerm2:
RcvTerm3:
RcvTerm4:
CaseConversion: U

Advanced Pad Motion (APM) Option, continued

Serial I/O Channel Dialog Box

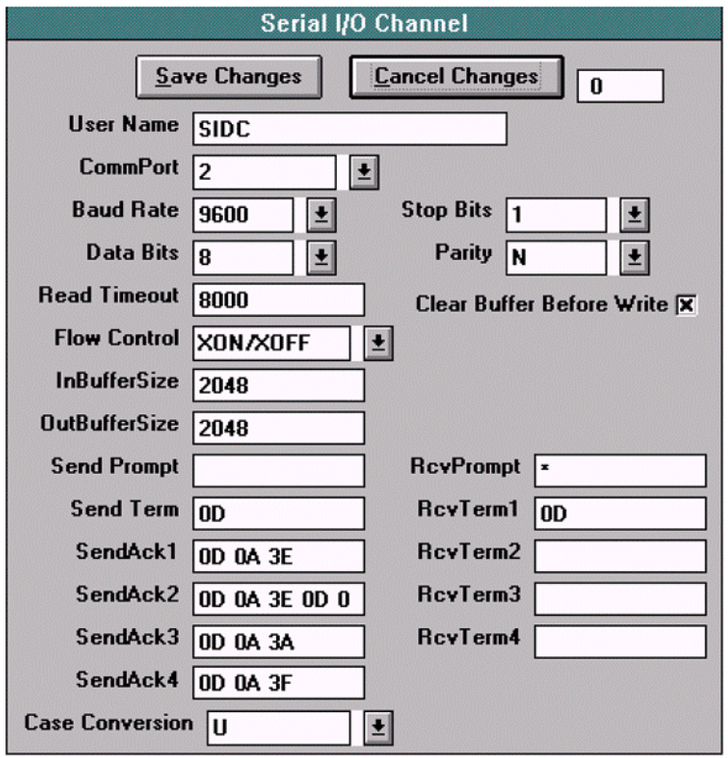

Figure 6-3. APM Serial I/O Channel Dialog Box

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Advanced Pad Motion (APM) Option, continued

SmartStep Status Commands

The following commands give information about the operation and status of the APM system components.

Command	Description
SS - System Status	During normal operation the status will be *0001, meaning all is well and the Controller is ready to buffer commands. During MP initialization, the first command sent to the Controller is “SS”. If the returned status is not *0001, the logic will run the init command. The init logic will toggle the POC_Reset output from OFF to ON, and back to OFF. If, after 20 seconds the Controller still fails to respond with the string *0001, an alarm will be displayed signaling a communications error. While doRun_Cmd On, a status value of *0005 or *0003 is normal.
SA1 - Tell Axis Status	Returns the current axis status as a four digit hexadecimal number, preceded by an asterisk. The current operation executes the status command before and after a polish cycle. If there is an error detect, the system will notify the operator of the alarm condition, and stop requesting wafers.

NOTE: **The exact type of alarm conditions to test for, when to test, and the exact sequence of events to occur if an alarm condition is detected during a polish cycle, is currently under development.**

continued on next page

Advanced Pad Motion (APM) Option, continued

Command	Description
SD1 - Tell Drive Status	Returns the current drive status as a four digit hexadecimal number, preceded by an asterisk. The current alarm logic makes sure the Controller will respond with a string *0010. The SD alarm logic only verifies the return of a 1 at string position 4, anything else is considered an alarm condition. To further troubleshoot the problem, the returned string should be converted to a binary 16 bit word, with each bit representing a status variable. For more information refer to the SmartStep User's manual.

continued on next page

Advanced Pad Motion (APM) Option, continued

Other SmartStep Commands

Although the IDC Controller has a large set of instructions, many are not required for APM operation and are not supported by the Ongaard logic programming. The start logic will send SS out to the Controller for 20 seconds or until SS returns *0001; which means the first command sent is the SS status command, the logic will trigger a reset if the string response is not *0001. If the response string is *0001 the SmartStep Controller is “READY TO BUFFER RS-232 COMMANDS”. Next, RN1 is sent to the Controller (Run Program 1) command, which executes program 1 stored in the Controller. Program 1 sets the default operation parameters for acceleration, deceleration, and velocity. Program 1 also contains a custom start position to take advantage of the 35 degrees of motion available between the home sensor and the negative over travel switch. The SmartStep Controller is programmed to use degrees as the units of measure. Range is represented by degrees of platen rotation (0 to 220 degrees). Speed is represented in degrees per second (0 to 120 degrees per second).
Speed command example: “VE120” and Range command example: “(ENP)=200”

Stored Programs

The following standard programs are stored in the Controller and are used to home and oscillate the APM. Not all programs stored in the Controller are listed below. Programs 4, 5, and 6 are used for limit switch testing and parking.

continued on next page

Advanced Pad Motion (APM) Option, continued

Table 6-3. SmartStep Controller Program 1

Command	Description
PR:1 AC0.5 DE0.5 VE36 (ENP)=216 GH-36 EN EP	
AC0.5	The default acceleration
DE0.5	The default deceleration
VE36	The default speed (36 degrees per second)
(ENP)=216	The default range of travel for the motor
GH-36	Go home at a speed of 36 degrees per second in the negative direction (216 degrees)
EN	End of Routine (SmartStep command)
EP	End Program Definition (SmartStep command)

continued on next page

Advanced Pad Motion (APM) Option, continued

Table 6-4. SmartStep Controller Program 2

Command	Description
PR:2 AC0.5 DE0.5 LW2,1 DA0 GO DA(ENP) GO EB EN EP	
LW2, 1	Loop while input 2 is ON (SmartStep command)
DA0	Distance Absolute (move to ZERO position) (SmartStep command)
GO	GO execute move (SmartStep command)
DA(ENP)	Move to endpoint defined (0 to 220 degrees) (SmartStep command)
GO	GO execute move (SmartStep command)
EB	End of command block
EN	End of Routine (SmartStep command)
EP	End Program Definition (SmartStep command)

continued on next page

Advanced Pad Motion (APM) Option, continued

Table 6-5. SmartStep Controller Program 98

Command	Description
PR:98 GT2 EN EP	
GT2	Go To Program 2 (SmartStep command)
EN	End of Routine (SmartStep command)
EP	End Program Definition (SmartStep command)

NOTE: **Program ninety eight is run while the MP run output is ON.**

continued on next page

Advanced Pad Motion (APM) Option, continued

Alarms

The IDC SmartStep Controller has three basic status registers System Status (SS), Axis Status (SA1), and Drive Status (SD1). Each status command returns a four digit hexadecimal number. The string must be converted to a 16 bit binary word for bit translation. The current level of alarm testing only makes sure the response is perfect, so the exact alarm is not known. The system only reports an alarm occurred. The returned string must be interpreted to diagnose the exact cause of the alarm condition. For detail information on the SmartStep status registers, refer to the SmartStep User's Manual.

continued on next page

Advanced Pad Motion (APM) Option, continued

System Status (SS)

If an SS error is detected, the following alarm will be displayed and the MP is halted. This failure could occur when the computer port COM2 is not fully configured by Windows, the computer COM port is defective, or the serial cable is disconnected. If the unit has worked before, it is safe to eliminate any issues of Windows or Communication port configurations. Make sure the power is not OFF on the SmartStep Controller, or the serial cable is unplugged. In a normal production environment, the SmartStep should power ON with the Tool. The SmartStep Controller can be reset from the MP Discrete I/O, by toggling the output POC_Reset, from OFF to ON, then back OFF. Ten seconds after the output is OFF, the SmartStep should be ready to respond with the required string *0001 when issued the SS command. It is not necessary to leave the reset output ON for longer than a couple of seconds.

ALARM!
MP1 Polish Oscillation Controller communications failure
The MP has been Halted!
OK
ALARM! | MP1 Polish Oscillation Controller communi
MP 2 Halted | Initialize MP

Figure 6-4. APM System Status (SS) Alarm Dialog Box

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Advanced Pad Motion (APM) Option, continued

Axis Status (SA1)

If an SA error is detected, the following alarm will be displayed, and the MP halted. The alarm is caused by the system not responding with the string *000A, which means the last move command was executed without any issues. The Axis Status register contains variables for Home Successful, Home Switch Status, (+/-) Limit Switch Status, and (+/-) Limit Switch Latched variables. While the motor is running, the string *0003 will be returned. No status commands are sent to the Controller while the motor is running. For more detailed information, refer to the SmartStep User's Manual. This alarm can occur when the range value is out of bounds and an over travel sensor is tripped. Re-initialize the MP to clear the alarm condition. If the system continues to detect this alarm, display the Serial I/O window, then type "EA0" to disable the SmartStep and allow you to move the platen to test the limit switches. Make sure to use the EA1 command to enable the SmartStep when the test is completed.

ALARM!
MP1 Polish Oscillation Conrtoller Axis failure detected
The MP has been Halted!
OK
ALARM! MP1 Polish Oscillation Conrtoller Axis failu

Figure 6-5. APM Axis Status (SA1) Alarm Dialog Box

continued on next page

Advanced Pad Motion (APM) Option, continued

Drive Status (SD1)

If an SD error is detected, the following alarm will be displayed, and the MP halted. The alarm is caused by the system not responding with the string *0010, which indicates the motor is enabled. This alarm is difficult to detect, it requires detailed information on the Controller operations. This alarm is an indication that something is wrong with the drive itself. For more information, refer to the SmartStep User's Manual.

ALARM!
MP1 Polish Oscillation Controller Drive failure detected
The MP has been Halted!
OK
ALARM! MP1 Polish Oscillation Controller Drive fail

Figure 6-6. APM Drive Status (SD1) Alarm Dialog Box

continued on next page

Advanced Pad Motion (APM) Option, continued

Speed and Range Modification

The following four dialog boxes are used to control APM polish oscillation speed and range: MPL Functions #, Conditioner Parameters, Recipe Edit, and the MPL # Dialog Boxes.

MPL Functions #

The MPL Functions dialog box is used to manually control the oscillation of the platen. Refer to Figure 6-7 to see the location of the MPL Functions dialog box APM fields and controls. The Rotation Parameters section has entries for both speed and range; each entry is modified using the up / down spinner. The Send button is used to accept the modified entry and send it to the SmartStep Controller. The Start / Stop button is used to manually start and stop the MP output (doPOC_RunCmd).

This dialog box is used to send manual operation parameters to the MP. The Rotation Parameters are used to configure the Polish Oscillation Controller Range and Speed. The up / down spinner closest to the value box is used to increment by 30, and the second spinner is used to increment by 1. If the value displayed is less than zero when the send button is pressed, the entry is terminated to zero. If the value is greater than 120, the entry is terminated to 120. Current limits are 0 to 120 degrees per second for speed, and 0 to 220 degrees for range.

If the polish platen is moving when Send is clicked, the new speed and range values will be sent to the Controller, but it will not stop. To start oscillation at the new settings, click the Start / Stop button.

continued on next page

Advanced Pad Motion (APM) Option, continued

Dialog Box Fields / Controls

Refer to MPL Functions #, as required, for an explanation of the MPL Functions dialog box APM fields and controls.

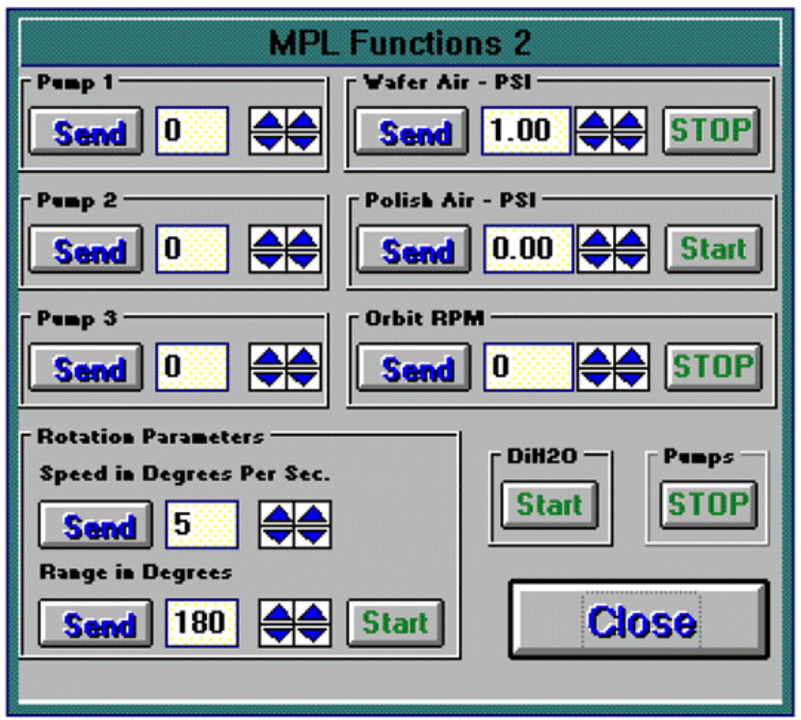

Figure 6-7. MPL Functions Dialog Box (with APM)

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Advanced Pad Motion (APM) Option, continued

Conditioner Parameters

The Conditioner Parameters dialog box is used to manually control the conditioner parameters. Refer to Figure 6-8 to see the location of the Conditioner Parameters dialog box fields and controls. The Rotation Speed and Range parameters are each modified using the up / down spinner. Each click on the up or down arrow increments the variable change by a factor of 1. The Save button is used to save the displayed parameters to the file “condx.dat”, where they become the default condition parameters. The Save button must be used to send the modified values to the file so Ongaard can read the values and operate at the default settings. The Condition Run button will send the modified parameters to the MP and run the conditioner.

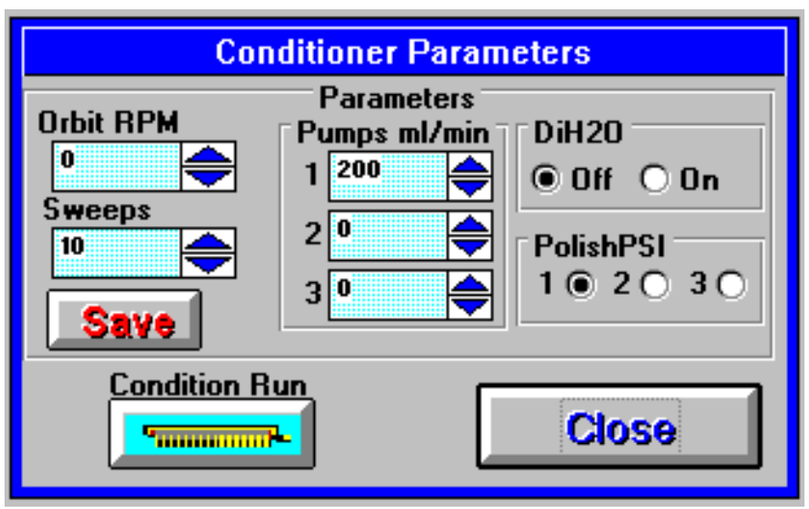

Figure 6-8. Conditioner Parameters Dialog Box (with APM)

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Advanced Pad Motion (APM) Option, continued

Recipe Edit

The Recipe Edit dialog box has columns for both APM speed and range. Refer to Figure 6-9 to see the location of the MPL Functions dialog box APM fields and controls.

The parameter limits are:

- Speed = 120 Degrees per second
- Range = 220 Degrees.

During the polish cycle, the recipe speed and range parameters are sent to the Controller between every recipe step. Toggling the output doPOC_RunCmd from ON to OFF will cause the modifications to occur. The SmartStep commands are buffered, so the modifications will not be used in the oscillation operation until the next time the output doPOC_RunCmd is toggled from OFF to ON.

The Range variable is used to set how far the platen will rotate (0 to +220 degrees). The Speed variable is used to set how fast to move the polish platen (0 to 120 degrees per second). For example, if the speed is set to 120, it should take about 2 seconds to travel 220 degrees. Setting the speed and range to zero will keep the ADM stationary during the polish cycle.

Velocity

The wafer head to polish head friction (which translates to drive shaft torque) is much higher during low orbital velocities. A velocity limiter is programmed into the APM software so that the APM can only be run during processes with orbital velocities of 75 RPM or greater. During pad conditioning, any orbital velocity may be used.

continued on next page

Advanced Pad Motion (APM) Option, continued

Fields / Controls

Refer to “Recipe Edit” on page 6-30, as required, for an explanation of the Recipe Edit dialog box APM fields and controls.

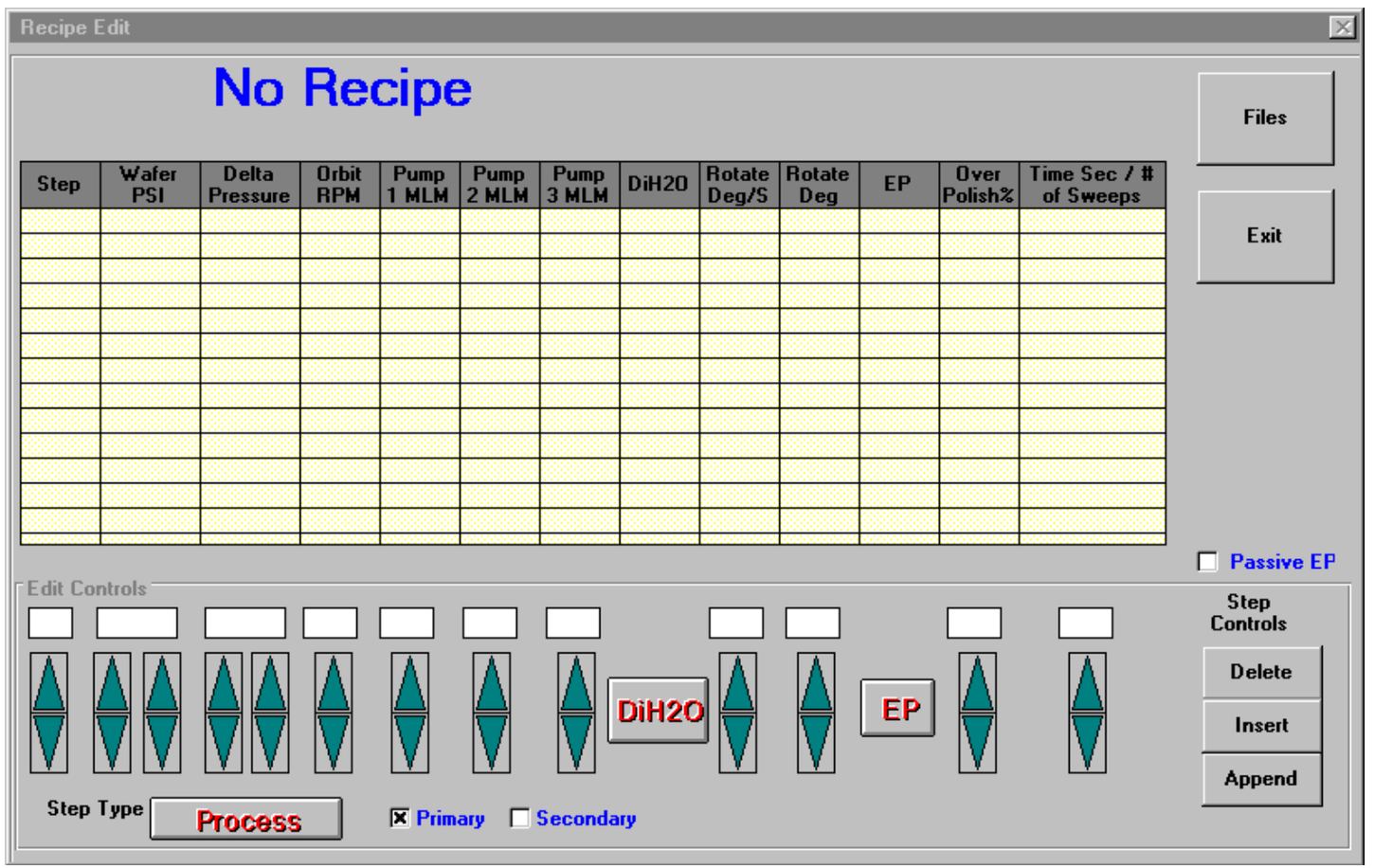

Figure 6-9. Recipe Edit Dialog Box (with APM)

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Advanced Pad Motion (APM) Option, continued

MPL # Dialog Boxes

The MPL # dialog box has changed to display the APM Speed and Range recipe columns in the grid and in the Status view.

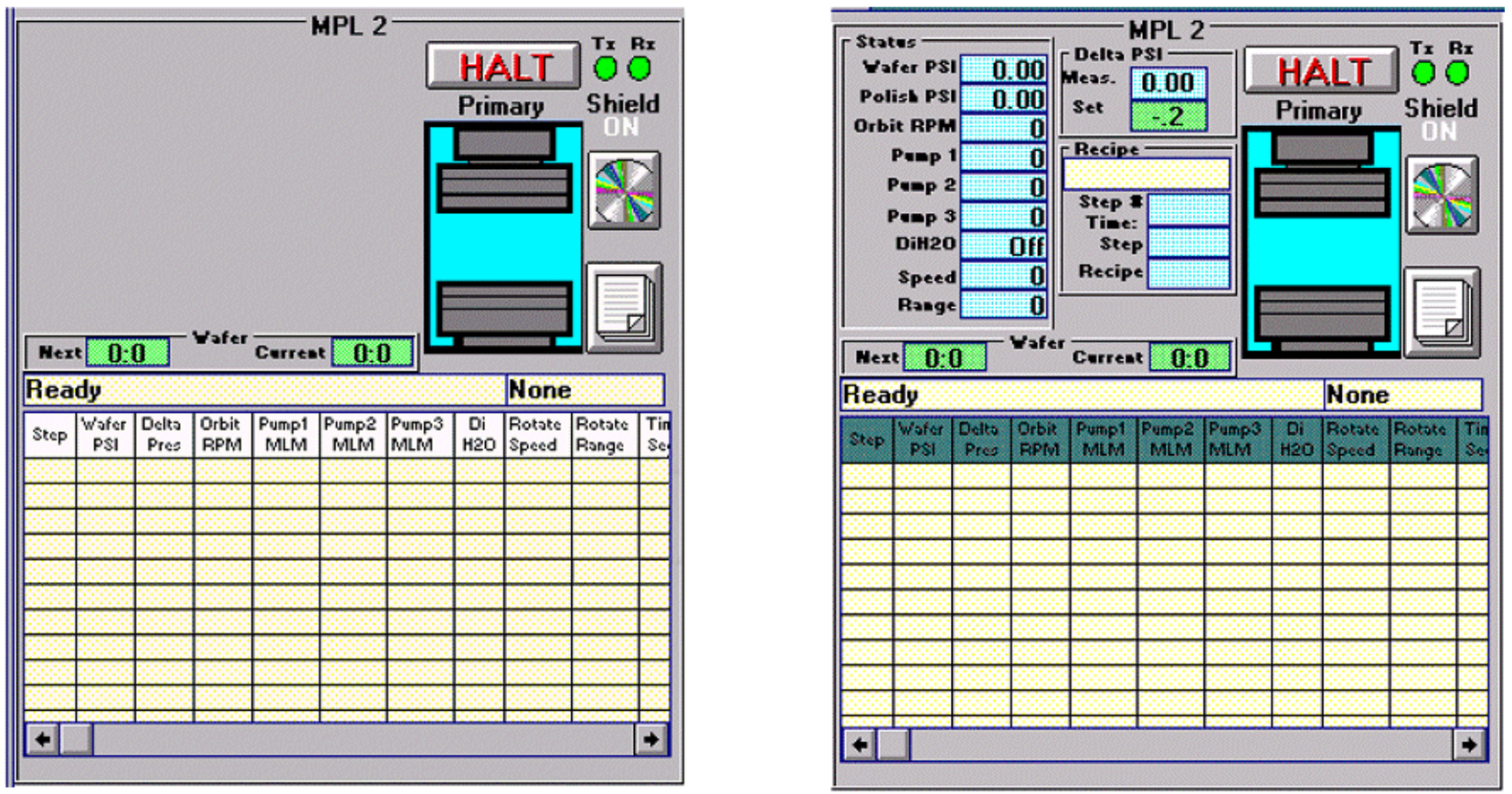

Figure 6-10. MPL # Dialog Box Views (with APM)

Brookside Endpoint Detection System

Introduction The Brookside Endpoint (EP) detection system for Tungsten (W) polish uses a dedicated computer to monitor relative friction during the polishing process. The relative friction of the pad moving across a W surface in the presence of slurry is lower than that for a TiN surface. By monitoring motor current, a change in relative friction detects the W endpoint. More information is available about the Endpoint Detection System in the Original Equipment Manufacturer (OEM) Manuals on the 676 CD-ROM in the Oem_manu.als\Brookside subdirectory.

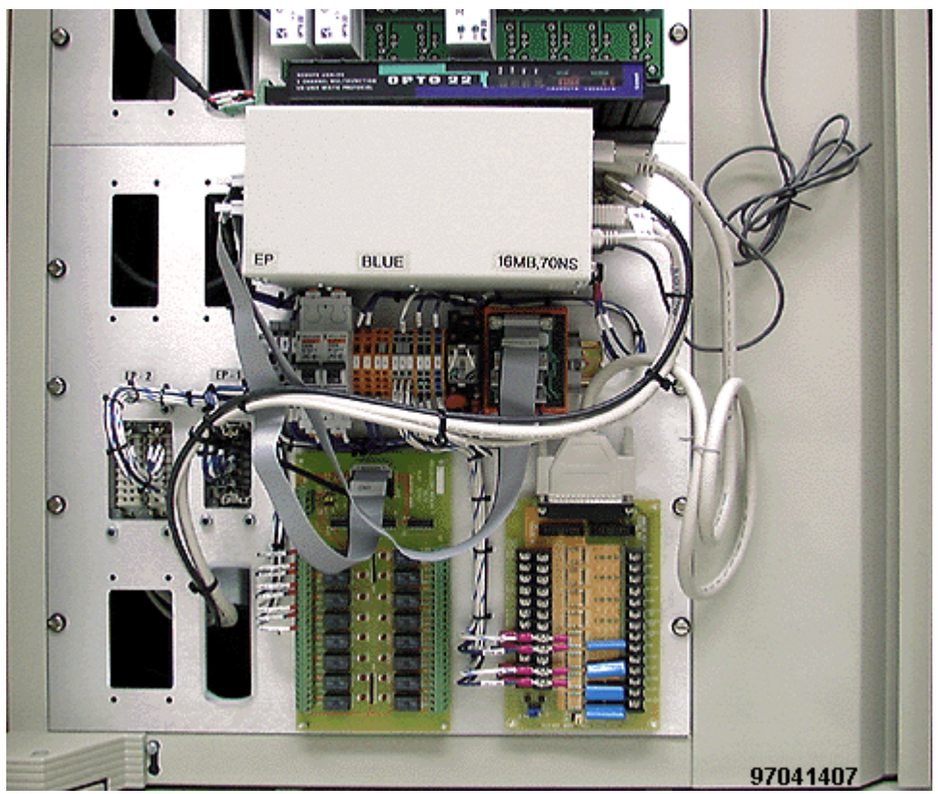

Figure 6-11. Brookside Endpoint Computer Panel Assembly

Luxtron Endpoint Detection System

Introduction The optional Luxtron Endpoint (EP) detection system stops the polishing process by detecting complete removal of the current process layer. The system uses a dedicated computer to monitor relative friction during the polishing process. The relative friction of the pad moving across an X surface in the presence of slurry is different than that for a Y surface. By monitoring motor current, a change in relative friction detects the X endpoint. The system is located in the Electrical Cabinet.

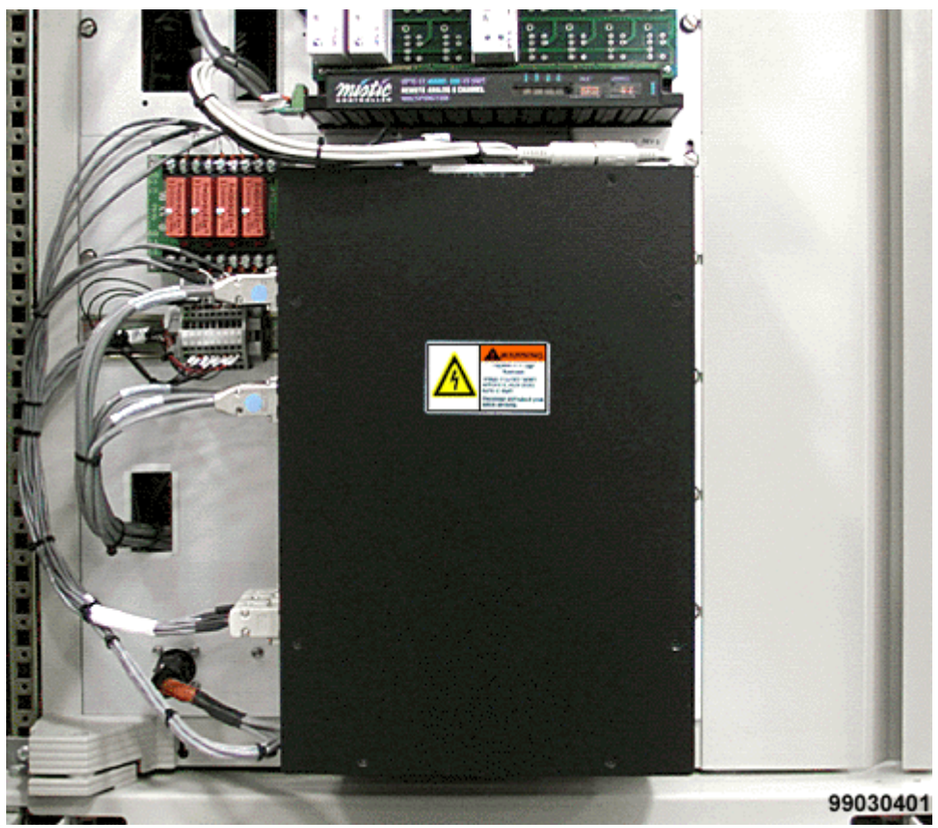

Figure 6-12. Luxtron Endpoint 9325 RTC Computer Assembly

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Luxtron Endpoint Detection System, continued

Purpose

Detects the endpoint of CMP process while the wafer is being polished, reducing downtime required for off-line measurements.

Components

- Cables
- Monitor
- Software
- Computer
- 4 digital inputs
- 4 digital outputs
- 8 Hall effect current sensors

Description

The computer and monitor are located in the Electrical Cabinet. The 8 Hall effect current sensors are the analog inputs located in the Electrical Cabinet on each motors wiring are connected to the computer and monitor and send motor current information to the computer. Only analog inputs are used at this time. A cable connects the computer to the Electrical Cabinet for sending start and stop signals to each motor controller using the 4 digital inputs and 4 digital outputs.

continued on next page

Luxtron Endpoint Detection System, continued

Operation

Table 6-6. Luxtron Endpoint (EP) Detection System Operation

Step	Description
1	Polishing process begins.
2	The computer uses current sensors to sense the current required by the polish and wafer motors to polish the wafer.
3	Computer monitors motor current for changes.
4	Amount of current required to run motors changes because the endpoint has been reached.
5	The computer sends a signal to stop the polish process.

F76 Endpoint Detection System

Introduction The optional F76 Endpoint (EP) detection system stops the polishing process at endpoint by detecting complete removal of the current process layer using spectral analysis of reflections from the surface of the polished wafer. Reduces the number of off-line measurements greatly increasing throughput.

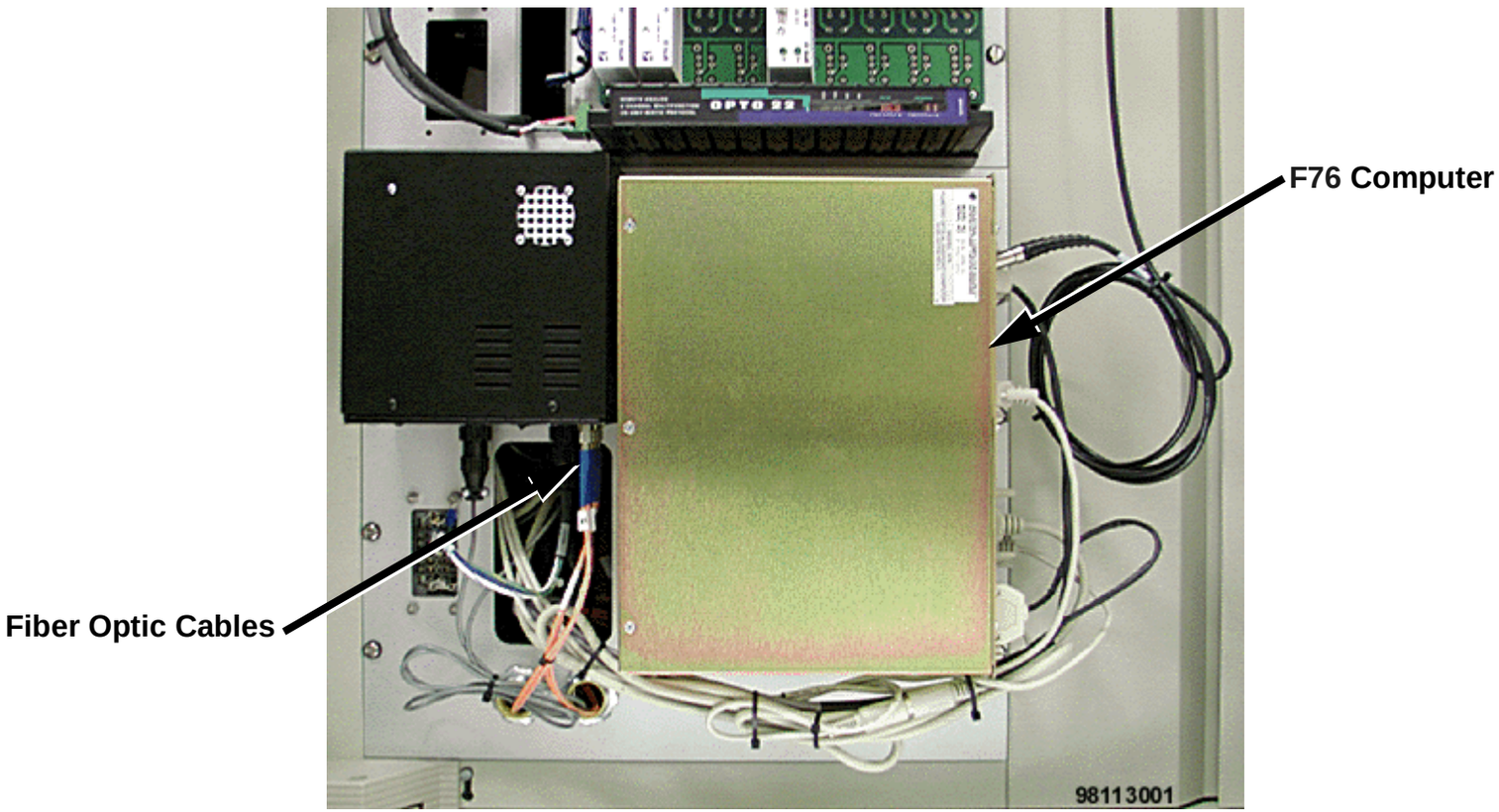

Figure 6-13. F76 Endpoint Computer Panel and Fiber Optics Cables

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F76 Endpoint Detection System, continued

Purpose

Detects the endpoint of tungsten CMP process using fiber optic light sensors while the wafer is being polished, reducing downtime required for off-line measurements. Independently monitors endpoint detection of all four polishing heads simultaneously. Does not affect polishing removal rates, improves wafer throughput, nor the allowed non-uniformity levels.

Components

- Pad Backer
- Software
- Light source
- Power supply
- Spectrometer
- Splash Guard
- Pentium II based computer
- Fiber optic cables from spectrometer to polish heads
- Fiber optic sensor with two fibers for each polish head

Description

Each polish head has a fiber optic sensor consisting of two fiber optic cables: one sending light from the light source, the other collecting light reflected from the wafer's surface. The computer, power supply, light source, and spectrometer are mounted to the metrology panel in the Electrical Cabinet. The fiber optic cables are routed between the Electrical Cabinet though the 676 into the splash guards to all four polish head pads. See Figure 6-13 on page 6-37 for photos of the system.

F76 Endpoint Detection System, continued

Process

The primary process application is tungsten CMP. Future upgrades may become available for copper CMP and oxide steps such as ILD and STI.

Operation

Table 6-7. F76 Ready Endpoint (EP) Detection System Operation

Step	Description
1	The light source bounces a beam of light off the wafer to sample the spectrum of light reflected using fiber optic cables mounted in each polish head pad.
2	Sample of the light spectrum is taken from the wafer.
3	Spectrometer determines the amount of light reflected and sends the information to the computer.
4	Polish process starts.
5	A wafer reflection sample is taken once every orbit of the polish pad.
6	Spectrum of reflected light changes because the endpoint has been reached.
7	The spectrometer sends information to the computer.
8	The computer detects the change and sends a signal to stop the polish process.

Notes:

Chapter 7

Fluids System

Contents This chapter contains the following topics:

Topic	See Page
Fluids System Components	7-2
Fluid Connections / Flow	7-9
Slurry Flow	7-11
DI Water Flow	7-12

Fluids System Components

Delta Valves Overview

Nine Delta valves are used to control the flow of DI water and slurry through the Tool during wafer processing. These valves are electronically controlled, normally-open or normally-closed devices, that operate when 24 volts is applied.

Delta Valve Identification

Table 7-1. Delta Valve Identification

Valve	Description
DV1	Supplies DI water to Slurry pump 1 for all MP heads. This valve is supplied by the low pressure regulator. Supplies no water during initial polishing and supplies 200 ml during the Ti Ni polishing.
DV2	Supplies DI water to flush Slurry pump 2 lines. This is supplied by the low pressure regulator.
DV3	Supplies DI water to flush Slurry 3A.
DV4	Supplies DI water to flush Slurry 3B.
DV5	Supplies slurry to Slurry 2 Input. This valve is normally closed and when activated through the software, it allows slurry to flow through the Slurry Filter 2 and to Slurry 2 Pump for all MP heads.
DV6 (For Oxide Only)	Supplies fluid to Slurry 3A.
DV7(For Oxide Only)	Supplies fluid to Slurry 3B.
DV8	Opens during pad conditioning (1) to supplies high pressure DI water.
DV9	Opens during pad conditioning (2) to supplies high pressure DI water.

continued on next page

Fluids System Components, continued

Peristaltic Pumps Overview

The main function of the peristaltic pump is to supply liquid for wafer processing. The pump has a three roller rotor, consisting of three free moving rollers. The cylinder in the middle of the rollers turns, causing the rollers to squeeze the liquid through the tubing. This action creates a vacuum that advances the liquid from roller to roller inside the tubing, moving approximately 200 ml of liquid per minute. During operation, the fluid that is being pumped never touches the pump components.

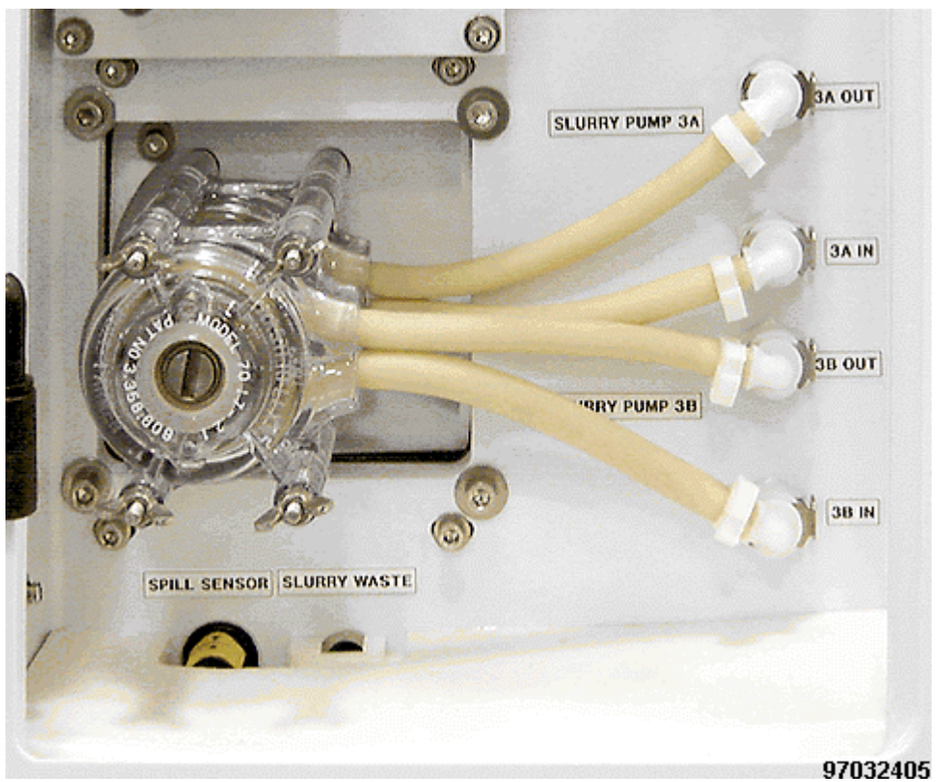

Figure 7-1. Typical Peristaltic Pump

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Fluids System Components, continued

Pump Component Description

Table 7-2. Peristaltic Pump Component Description

Item	Description
Pump Head	Contains a three roller rotor which supplies the peristaltic action to force the fluids through the tubing.
Motor Drive	Supplies the power to rotate the rollers in the pump head.
Tubing	Contains the fluid as it is forced through the pump.

Peristaltic Pump Maintenance

During the process of pumping the fluid to the polish head, the tubing in the pump will eventually flatten, causing the rollers not to function properly. When the volume of fluid pumped through the tubing decreases, the tubing needs to be changed according to the specifications in Replace Slurry Pump 1 and 2 Tubing in the PM procedures.

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Fluids System Components, continued

High and Low Pressure Regulators

The high and low pressure regulators control the pressure of the DI water into the Tool. These regulators are located above the facility connections on the chase side of the Main Tool.

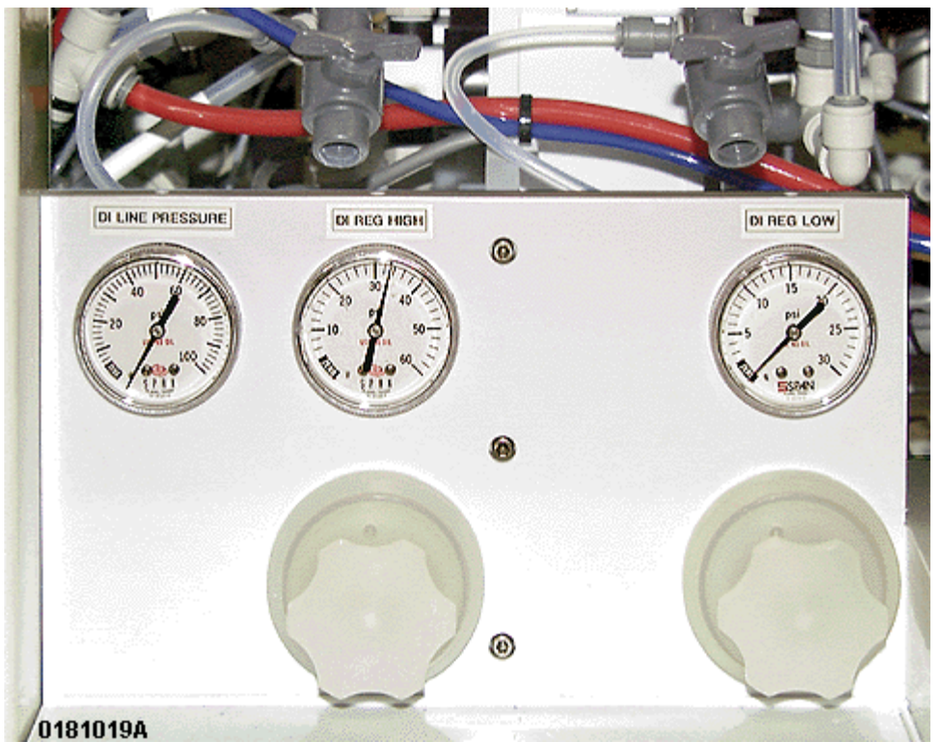

Figure 7-2. High and Low Pressure Regulators

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Fluids System Components, continued

Ultra Pure Valves

These valves control water flow across the wafers in the wet cassette and the Spray Box.

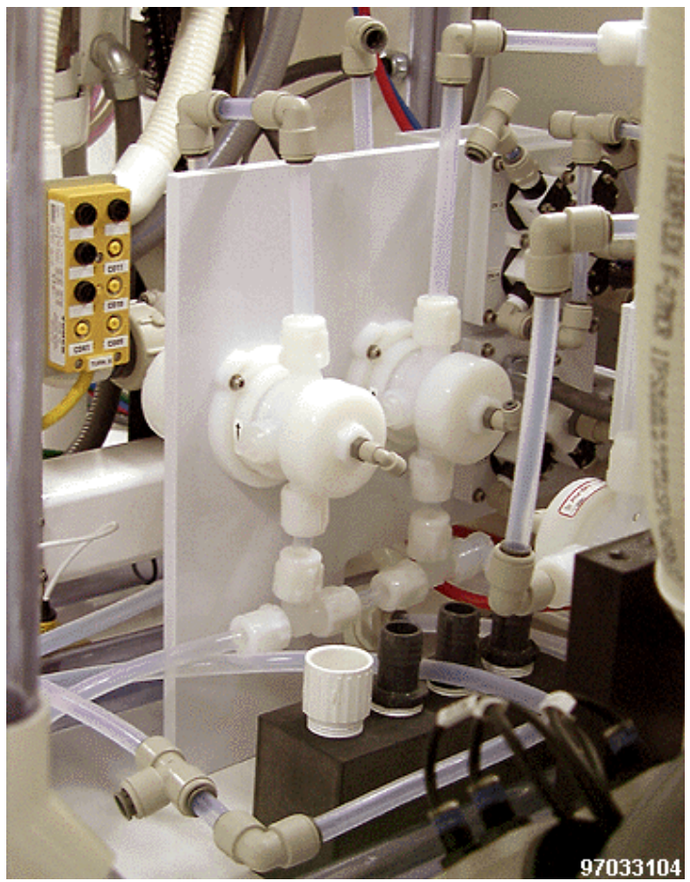

Figure 7-3. Typical Ultra Pure Valves

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Fluids System Components, continued

Diverter Valves

There are four diverter modules in the AvantGaard™ 676, one for each head. Each module contains two valves, one for Recycle Slurry 2, and one for Recycle Slurry 3A. These valves divert the slurry from the drains during the polish process, into the waste storage area or the recycle system.

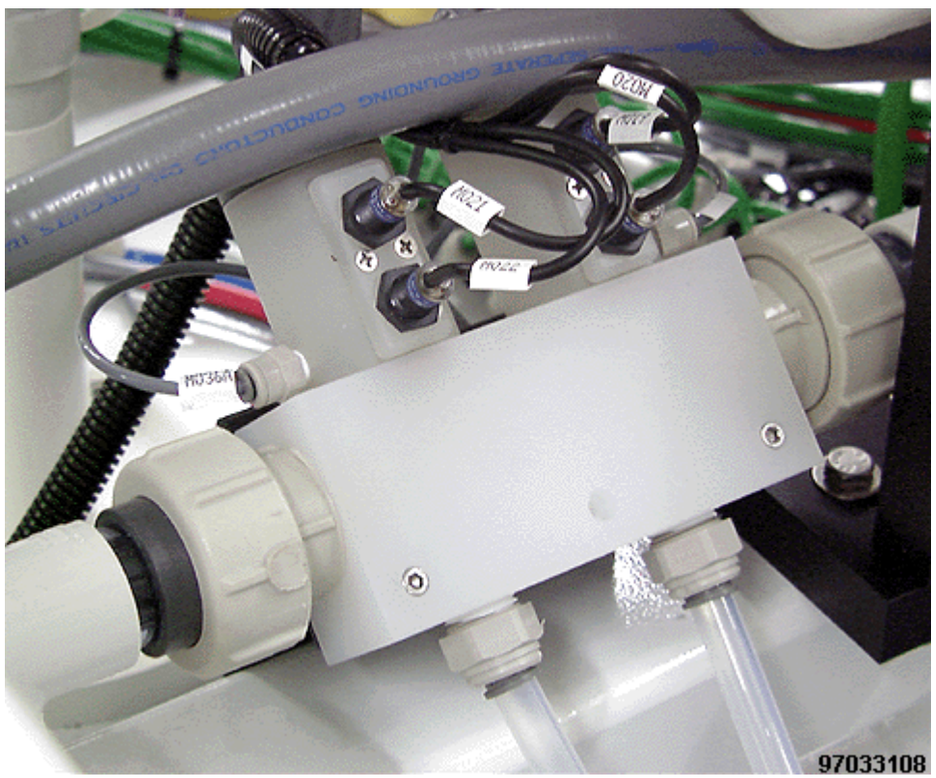

Figure 7-4. Diverter Valves

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Fluids System Components, continued

Filters and Strainers

The filters and strainers in the system filter out any large clumps of slurry or contamination before it enters the Tool. Slurry 2 Filter is used to make sure any large clumps of undiluted slurry chemicals do not enter the slurry modules.

Figure 7-5. Filters and Strainers

Fluid Connections / Flow

Overview

The fluid connections for the Tool are located on the lower chase side of the Main Tool. Facility fluid supply lines must be positioned correctly to connect with the fluids connections on the Tool. Refer to Table 7-3 for the specifications for the typical facility fluids connections. Use the information in Figure 7-6 to identify the facility fluid services connected to the installed tool. All fluids enter the Tool through the small ports in the top row of the fluids connection panel on the lower chase side of the Tool. All fluids exit the Tool through the larger ports in the bottom row.

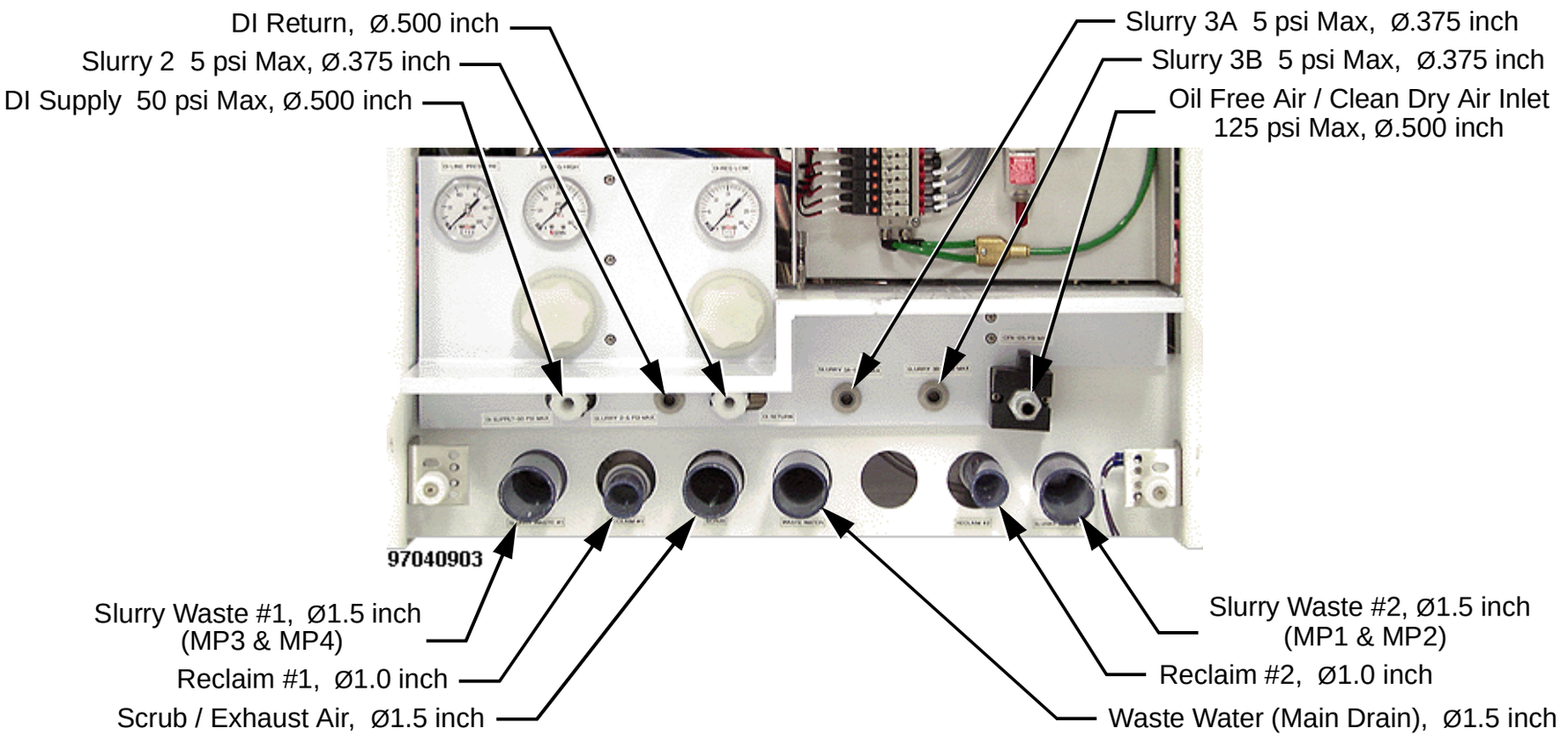
DI Return, Ø.500 inch
Slurry 2 5 psi Max, Ø.375 inch
DI Supply 50 psi Max, Ø.500 inch
Slurry 3A 5 psi Max, Ø.375 inch
Slurry 3B 5 psi Max, Ø.375 inch
Oil Free Air / Clean Dry Air Inlet
125 psi Max, Ø.500 inch
97040903
Slurry Waste #1, Ø1.5 inch
(MP3 & MP4)
Reclaim #1, Ø1.0 inch
Scrub / Exhaust Air, Ø1.5 inch
Slurry Waste #2, Ø1.5 inch
(MP1 & MP2)
Reclaim #2, Ø1.0 inch
Waste Water (Main Drain), Ø1.5 inch

Figure 7-6. Main Tool Fluid Connections

Fluid Connections / Flow, continued

Fluids Specifications

Table 7-3. Table 7-3 gives the specifications for the typical facility fluids connections. Refer to Figure 7-6 for the locations of the facility fluid services connected to the installed Tool. All utilities connected to the Tool must be clearly and permanently labeled as to their contents and function.

Table 7-4. Main Tool Fluids Connections and Specifications

Input / Output	Connection Size/type	Pressure	Flow	Confirmed (Date And Initial)
DI Return	1/2” flaregrip	50 psi	0-5 gpm max.	
Slurry 2	3/8”	5 psi	0.5 gpm	
DI Supply	1/2” flaregrip	50 psi	0 - 5 gpm	
Slurry Waste #1	1 1/2”		2 gpm	
Reclaim #1	1”		1 gpm	
Scrub	1 1/2”	1.0” - 4.0” H_20	50 scfm	
Waste Water	1 1/2”		5 gpm max	
Reclaim #2	1”		1 gpm	
Slurry Waste #2	1 1/2”		2 gpm	
OFA / CDA	1/2” NPT	90 - 125 psi	18 scfm	
Slurry 3b	3/8”	5 psi	0.5 gpm	
Slurry 3a	3/8”	5 psi	0.5 gpm	

continued on next page

Fluid Connections / Flow, continued

Input / Output	Connection Size/type	Pressure	Flow	Confirmed (Date And Initial)
Base Drain (To CDS)	3/4”		1 gpm	
Base Scrub	6”	2.0” - 4.0” H_20	300 scfm	

NOTE: **The CDA must be Oil Free, filtered to 0.02mm, and dried to a dew point of at least -80 degrees C. [IAW SEMI F29]**

Slurry Flow

Overview The following table describes how slurry flows through the Tool.

Table 7-5. Slurry Flow

Step	Action
1	Slurry enters chase side, second port from the left.
2	Slurry flows through delta valve 5.
3	Slurry is diverted into Slurry Filter 2.
4	Slurry flows into the pump boxes for each head.
5	Slurry flows through the peristaltic pumps.
6	Slurry is pumped into the polish heads.
7	Slurry drains off the heads with the DI water and contaminants.
8	Slurry flows into the drain as waste.

DI Water Flow

DI Water Flow

The following table describes the DI water flow through the Tool.

Table 7-6. DI Water Flow

Step	Action
1	DI water enters the chase side first port on the left.
2	The first “T” supplies DI water to the high pressure regulator.
3	After the high pressure regulator, the DI goes to delta valves 8 and 9 which supply high pressure DI to the pad conditioner, rinse lines, and to each slurry box.
4	The line pressure continues to another “T” where it splits to go to the ultra pure valves 1, 2, 3, and 6, and to the low pressure regulator. • The ultra pure valves supply DI water to the wet cassette basin and the Spray Box. • The low pressure regulator supplies DI to delta valves 1 - 4 which supply DI water to slurry 1, and rinse water to slurry 2, 3A, and 3B respectively.
5	The line pressure DI water then exits on the right side, returning to the Fab recirculating system, or going to waste.

Notes:

Chapter 8

Electrical Systems

Contents This chapter contains the following topics:

Topic	See Page
Electrical Cabinet Purpose	8-2
Safe Operation	8-4
Electrical Cabinet	8-5
Relay Functions	8-7
Cabling	8-10
Cable Bundles	8-13
Mistic Brick Layout	8-16
Interconnect Box 1	8-17
Interconnect Box 2	8-18

Electrical Cabinet Purpose

Purpose

DANGER - DO NOT TOUCH WIRES IN THE ELECTRICAL CABINET WHEN ELECTRICAL POWER IS CONNECTED TO THE TOOL. THREE PHASE, 208VAC IS A VERY HAZARDOUS INDUSTRIAL POWER VOLTAGE THAT, DUE TO THE FREQUENCY THAT IS CLOSE TO THE HUMAN HEARTBEAT, CAN CAUSE LOSS OF LIFE.
ANY TWO WIRES OF THREE-PHASE AC VOLTAGE CAN SHOCK WITHOUT REFERENCE TO GROUND. THIS CAPABILITY CAUSES THREE-PHASE AC VOLTAGE TO ACT SIMILAR TO DC VOLTAGE THAT MAY CAUSE THE INDIVIDUAL TO NOT LET GO OF THE WIRE.

DANGER - USE THE EXAMPLE LOCKOUT / TAGOUT PROCEDURE GIVEN IN CHAPTER 3, OR A SITE APPROVED LOCKOUT / TAGOUT PROCEDURE THAT IS IN COMPLIANCE WITH OSHA 1910-147, OR OTHER APPLICABLE REGULATIONS, BEFORE DOING ANY MAINTENANCE OR SERVICING REQUIRING ACCESS TO ANY HIGH VOLTAGE PANEL ASSEMBLIES, OR HAZARDOUS AREAS OF THE TOOL. FOLLOW ALL ELECTRICAL SAFETY PRACTICES. TOOL USES LETHAL ELECTRICAL VOLTAGES AND CURRENTS.

DANGER - MAKE SURE THE GROUND WIRE SIZE IS CORRECT AND IT IS PROPERLY CONNECTED TO THE POLISHER TO PREVENT PERSONNEL INJURY OR LOSS OF LIFE. INCORRECT GROUND WIRE CONNECTION CAN RESULT IN PERSONNEL INJURY OR LOSS OF LIFE.

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Electrical Cabinet Purpose, continued

Purpose Cont

All electrical power used by the AvantGaard™ 676 is connected through the Electrical Cabinet. Power is then distributed to the various panels and modules. All logic controls used by the Tool are located in the Electrical Cabinet. This chapter also identifies the wiring conventions used by SpeedFam-IPEC.

[S/N 3031] This Tool was originally built with white colored neutral power wires in some locations. To comply with applicable CE regulations, these locations now have light blue heat shrink tubing, with a “NEU” label, to end mark the white neutral power wires. This Tool was originally built with solid green colored earth ground wires in some locations. To comply with applicable CE regulations, these locations now have GRN/YEL bi-color heat shrink tubing to end mark the green earth ground wires.

Safe Operation

Operator Safety

During production, there is no operator exposure to electrical hazards when:

- All cabinet doors and access panels are closed,
- Interlocks are not overridden,
- The EMO button is not disabled,
- The wafer polisher is installed with proper earth grounding, and
- The wafer polisher is installed in accordance with the National Electrical Code.

Electrical Cabinet

Overview

Figure 8-1 shows the Electrical Cabinet. Refer to the IPB for a complete breakdown of the Electrical Cabinet assemblies, and location of components.

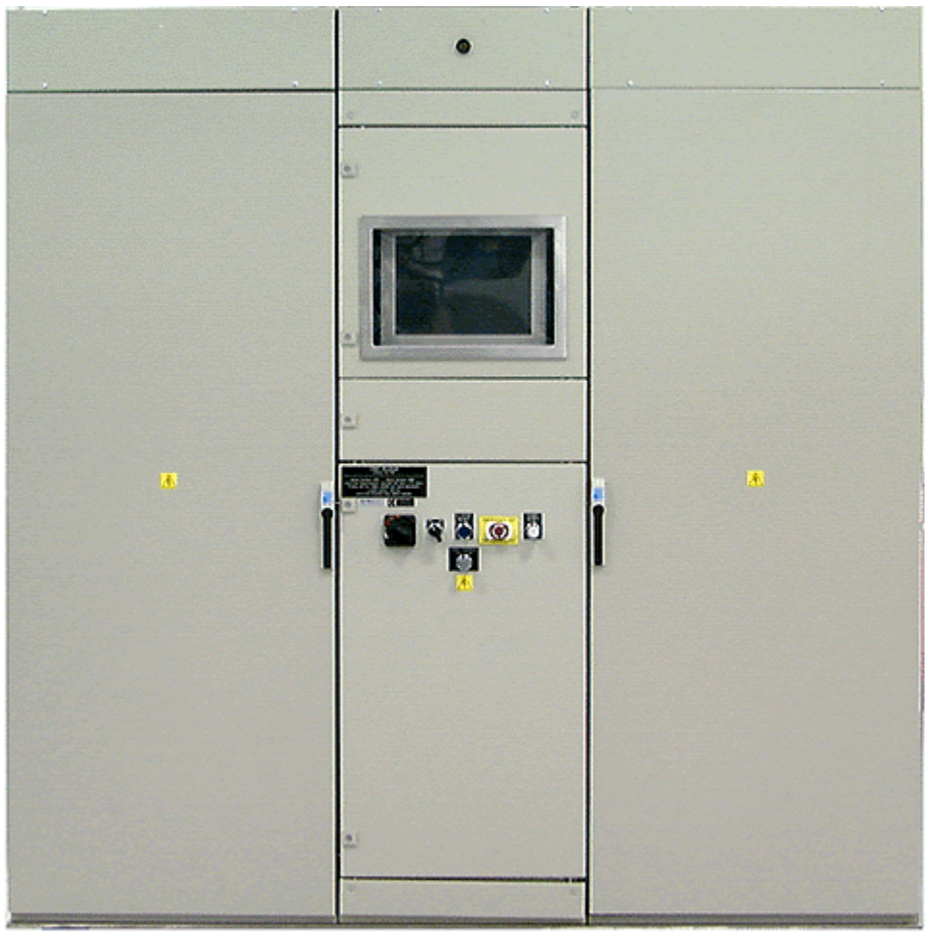

Figure 8-1. Electrical Cabinet

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Electrical Cabinet, continued

Components

Behind the door on the left-hand side of the Electrical Cabinet is an interlocked swing panel that contains MP 1 and 2 low voltage panel assemblies, a low voltage pad conditioner panel assembly, and the low voltage C2C panel assembly. The rear of the swing panel gives access to the rear side of each of these panel assemblies. The rear side of most of these panel assemblies contain racks of input / output (I/O) modules. High voltage MP panel assemblies and a high voltage pad conditioner panel assembly are located on the rear wall.

The center section houses the system control computer, a monitor and control station and, in the lower portion, the main power panel.

Behind the door on the right-hand side of the Electrical Cabinet is an interlocked swing panel that contains MP 3 and 4 low voltage panel assemblies, a low voltage pad conditioner panel assembly, and an optional Endpoint Panel assembly. The rear of the swing panel gives access to the rear side of each of these panel assemblies. The rear side of most of these panel assemblies contain racks of input / output (I/O) modules. High voltage MP panel assemblies, a high voltage pad conditioner panel assembly, and the high voltage C2C panel assembly containing the robot controller are located on the rear wall.

All internal panel assemblies are modular so they can be removed and replaced quickly to minimize downtime.

Relay Functions

Introduction The following tables describe the functions of the relays used on the Tool.

Table 8-1. Main Power Relays

Relay Name	Conditions to Energize	Enables
EMERGENCY OFF (EMO)	High voltage cabinet outer door switches EMO's not pushed Main power ON ON/OFF switch ON Reset button pushed	Buss bars powered ON High voltage sent to individual panel locations EMO reset button lit
Relay 1 (Global EMO) (Panel Interlock)	Panel interlocks made Panel reset pushed	Contact points on each panel will energize local EMO (Panel Interlock) relay on each panel

continued on next page

Relay Functions, continued

MP Relays

Table 8-2. MP Relays

Relay Name	Conditions to Energize	Enables
Relay 8 (Local EMO) (Panel Interlock)	Relay 1 Global EMO (Panel Interlock) energized	Relay 4 Enables 24V to line #2501
Relay 2 (Slurry Enable)	Output CH8 active Relay 8 energized	Supplies AC to Minariks
Relay 3 (Spindle Enable)	Output CH9 active Relay 8 energized	Supplies COM to Toshiba enable
Relay 4 (208 3 phase to Toshiba Controller)	Relay 8 energized	Supplies AC to Toshiba

continued on next page

Relay Functions, continued

C2C Relays

Table 8-3. C2C Relays

Relay Name	Conditions to Energize	Enables
Relay 3 (Local EMO) (Panel Interlock)	Relay 1 (Main EMO) (Panel Interlock) energized	Robot enabled Enables 24V to line #2501
Relay 4 (Sensor array 1 & 2 select)	Output CH78 active	Switches between sensor array 1 and 2

Pad Conditioner Relays

Table 8-4. Pad Conditioner Relays

Relay Name	Conditions to Energize	Enables
Relay 3 (Local EMO) (Panel Interlock)	Relay 1 (Global EMO) (Panel Interlock) energized.	Enables 24V to line #2501 Enables COM to line #2502
Relay 3 (Local EMO) (Panel Interlock)	Relay 1 (Global EMO) (Panel Interlock) energized.	Enables 24V to line #2501 Enables COM to line #2502

Cabling

Introduction Table 8-5 lists the wire / cable numbers used in the Tool.

Table 8-5. Cabling

Item	Description
2000	24V output of PS1
2101 (24 V)	24V from PS1 After appropriate CB on panel
2501 (STOP 24)	24V from 2101 Switched by local EMO relay • off during an interlock violation • This signal feeds the digital output modules
2502 (STOP COM)	Return to PS1 switched by pad conditioner local EMO relay (relay #3) • Switched common • Active when 2501 is active • Only used on Pad Conditioner 1 & 2 low voltage panel • Only place switched common feeds an OPTO 22 brick • Signals used for pad conditioner at this OPTO 22 are: P088 - P094 (pad 1) P120 - P126 (pad 2)
5000	5V output of PS2
5001	5V after appropriate CB
1200	12V output of PS3
1201	12V after appropriate fuse
-1200	-12V output of PS4 (Not on 2800 series)

Cabling, continued

Item	Description
-120	-1200 after terminal block in low voltage distribution
-121	-12V after appropriate fuse
I200	24V from DC/DC converter on appropriate panel
ICOM	COM from DC/DC converter on appropriate panel

Cable Bundles

Introduction Table 8-6 lists the wire / cable bundles used in the Tool.

Table 8-6. Cable Bundles

Item	Description
C2C -1	The -1 cables supply +5V, +12V, -12V and +24V power from the power supply shelf to the panel. Also carries COM, ICOM, 24V Sens, 2101, and 2102.
C2C -2	Digital channels C001 - C014, power, and common. Also supplies power and common to upper and lower C2C pneumatic panels.
C2C -4	Digital channels C016 - C047, power, and common. Also supplies power from the low voltage panel to the Tool.
C2C -5	Digital channels C048 - C071, power, and common. Also supplies the wafer sensor array switching functions.
Pad 1 (2) -1	See C2C-1.
Pad 1 (2) -3	Low voltage to high voltage. Digital channels P080 - P094 [Pad 1], P112 - P135 [Pad 2], 24V and common to respective high voltage panel.
Pad 1 (2) -4	1/2 digital and 1/2 analog for both Pad 1 and 2. P096 - P103, PA00 - PA15 [Pad1]. P128 - P135, PA16 - PA31 [Pad2].
Pad 1 (2) -6	The -3 cable comes in to the pad conditioner controller, as well as AC from the Buss bars, and leaves on the -6 cable. Digital channels P081 - P113 run straight through the pad conditioner on the -6.
MP? -1	See C2C -1.

continued on next page

Cable Bundles, continued

Item	Description
MP? -3	Power supply to MP high voltage panels. Also supplies digital and analog signals and supplies 12V to the -6 cable. MA24 - MA29 to the Minarik board to the slurry motor speed. MA30 - MA31 to the Toshiba controller to motor speed.
MP? -4	Channels MA00 - MA23. +24V on 2101 and COM to the Tool.
MP? -5	Digital channels M016 - M047. Power to the Tool upper and lower MP pneumatic panels.
MP? -6	AC signals for Toshiba polish and wafer head motors. -6 sends signals to the slurry box motors then to the Minarik. Also sends 12V to the Tool on the 2103 cable from the low voltage to the high voltage to the interconnect boxes.
EP -1	5V, +12V, -12V, 24V, COM, 5V Sens, +12V Sens, -12V Sens.
EP -2	Digital channels, power, and common.

Mistic Brick Layout

Introduction The following diagram shows the layout of the mistic bricks in the Electrical Cabinet. Use the diagram as a guide to locate an Opto 22 module when given the channel number or wire number. Refer to Appendix C for a list of the Mistic Driver Codes.

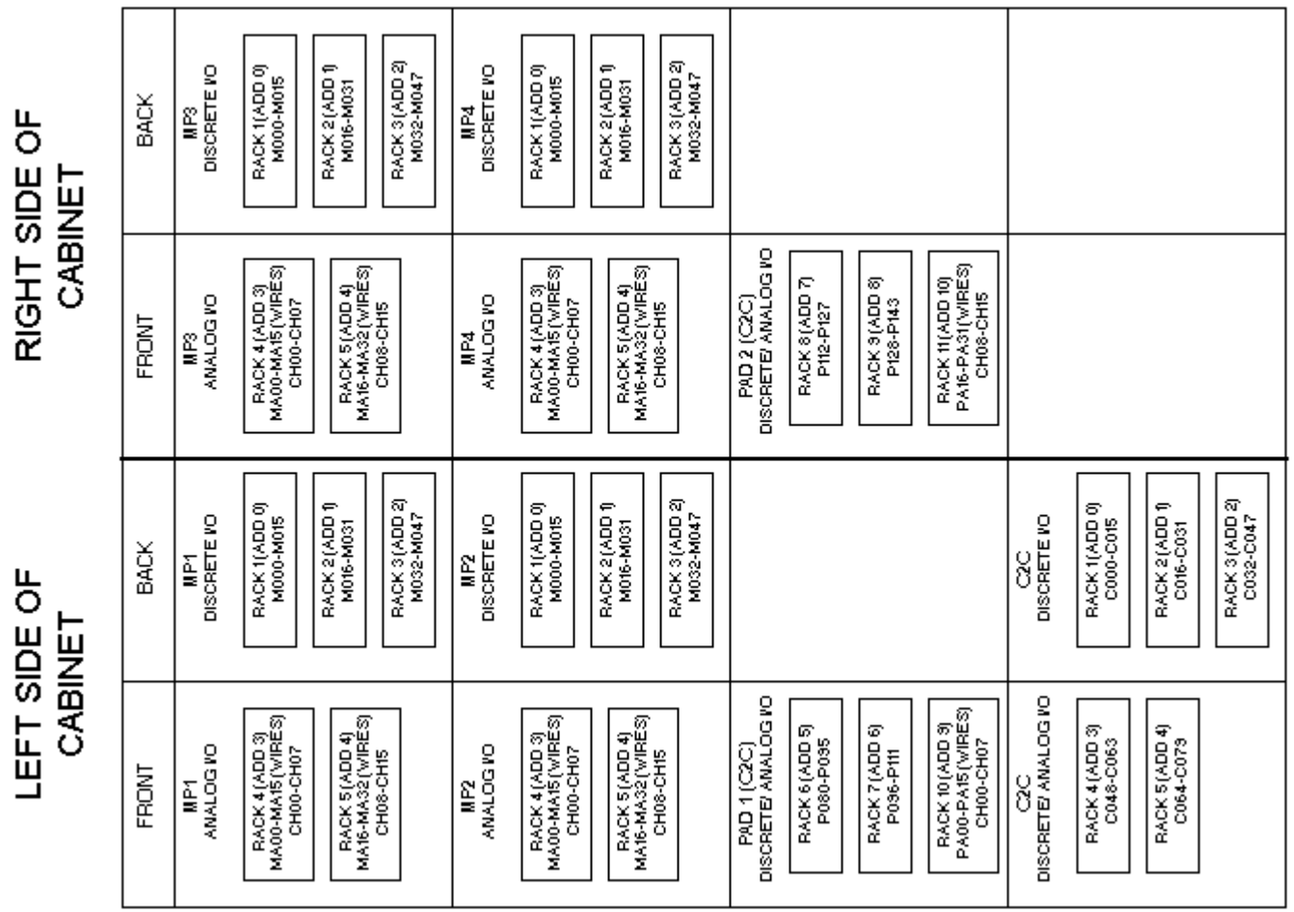
LEFT SIDE OF CABINET
RIGHT SIDE OF CABINET
FRONT
BACK
MP1 ANALOG I/O
RACK 4 (ADD 3) MA00-MA15 (WIRES) CH00-CH07
RACK 5 (ADD 4) MA16-MA32 (WIRES) CH08-CH15
MP1 DISCRETE I/O
RACK 1 (ADD 0) M000-M015
RACK 2 (ADD 1) M016-M031
RACK 3 (ADD 2) M032-M047
MP2 ANALOG I/O
RACK 4 (ADD 3) MA00-MA15 (WIRES) CH00-CH07
RACK 5 (ADD 4) MA16-MA32 (WIRES) CH08-CH15
MP2 DISCRETE I/O
RACK 1 (ADD 0) M000-M015
RACK 2 (ADD 1) M016-M031
RACK 3 (ADD 2) M032-M047
P&D 1 (C2C) DISCRETE/ ANALOG I/O
RACK 6 (ADD 5) P080-P095
RACK 7 (ADD 6) P096-P111
RACK 10 (ADD 9) PA00-PA15 (WIRES) CH00-CH07
C2C DISCRETE/ ANALOG I/O
RACK 4 (ADD 3) C048-C063
RACK 5 (ADD 4) C064-C079
C2C DISCRETE I/O
RACK 1 (ADD 0) C000-C015
RACK 2 (ADD 1) C016-C031
RACK 3 (ADD 2) C032-C047
MP3 ANALOG I/O
RACK 4 (ADD 3) MA00-MA15 (WIRES) CH00-CH07
RACK 5 (ADD 4) MA16-MA32 (WIRES) CH08-CH15
MP3 DISCRETE I/O
RACK 1 (ADD 0) M000-M015
RACK 2 (ADD 1) M016-M031
RACK 3 (ADD 2) M032-M047
MP4 ANALOG I/O
RACK 4 (ADD 3) MA00-MA15 (WIRES) CH00-CH07
RACK 5 (ADD 4) MA16-MA32 (WIRES) CH08-CH15
MP4 DISCRETE I/O
RACK 1 (ADD 0) M000-M015
RACK 2 (ADD 1) M016-M031
RACK 3 (ADD 2) M032-M047
P&D 2 (C2C) DISCRETE/ ANALOG I/O
RACK 8 (ADD 7) P112-P127
RACK 9 (ADD 8) P128-P143
RACK 11 (ADD 10) PA16-PA31 (WIRES) CH08-CH15

Figure 8-2. Mistic Brick Layout

Interconnect Box 1

Introduction Figure 8-3 shows the #1 interconnect box layout. Refer to the IPB for a complete breakdown of the assemblies and locations of components.

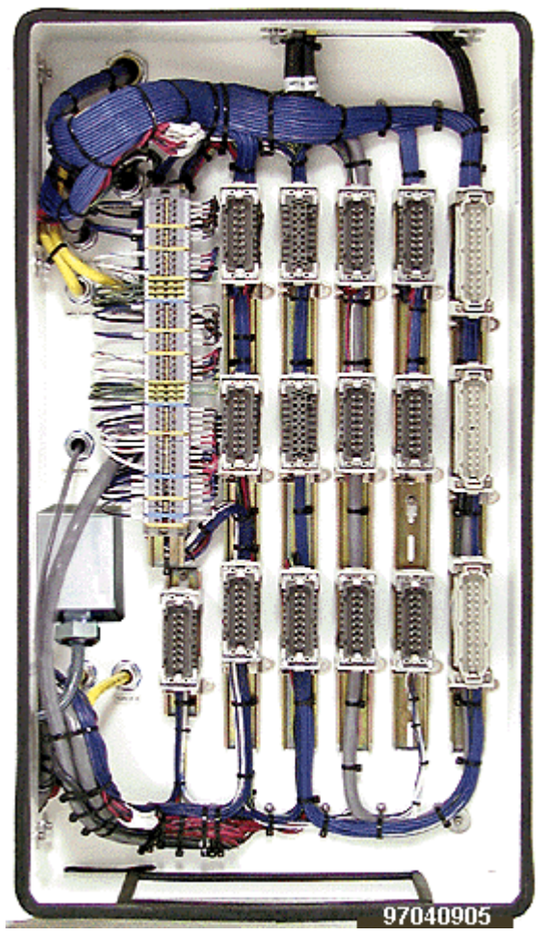

Figure 8-3. Interconnect Box 1

Interconnect Box 2

Introduction Figure 8-4 shows the #2 interconnect box layout. Refer to the IPB for a complete breakdown of the assemblies and locations of components.

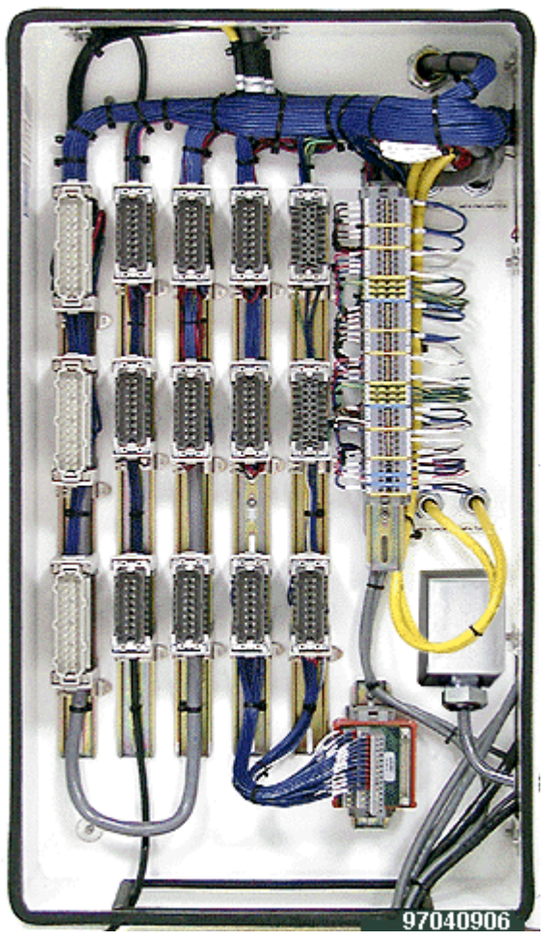

Figure 8-4. Interconnect Box 2

Chapter 9

Tool Points

Contents This chapter contains the following topics:

Topic	See Page
Introduction	9-2
Tool Point Tasks	9-3
Tool Point Commands	9-4
Robot Positions	9-6
Tool Point Variables	9-7
Tool Points	9-11

Introduction

Purpose

Although the process of teaching Tool Points is time consuming, it has the greatest impact on the polishing process. If wafers are not placed correctly in the system, they can be destroyed.

The following pages give information about which Tool Points can be changed, the commands used to teach Tool Points, and the Tool Point procedure.

Displaying the Serial I/O Window

To make adjustments to Tool Points, display the C2C Serial I/O Window to establish communication with the robot controller. For information on displaying the C2C Serial I/O Window, refer to “C2C Serial Window” on page 4-10.

Tool Point Tasks

Adjustable Tool Points

Table 9-1. Tool PoInts That May Require Adjustment

Task	Tool Point
Pick Wafer	• Theta Cassette #1. • Theta Cassette #2. • Delta R to push against wafer for pick.
Index R1 for Pick	• Case 1 - 25 (caseof wafer_working).
Index R2 for Pick	• Case 26 - 50 (caseof wafer_working).
Align Wafer	• Case 1 and 2. • Case 3 and 4.
Load Planarizer A	• Theta to align with MP. • R move under head. • Z move to place wafer.
Unload Planarizer A	• Theta - must match Load Planarizer A theta. • R position - must match Load Planarizer A R. • Z move to pick wafer from the pad. (This is the actual the Tool Point.)
Load Scrub 1 and Scrub 2	• Theta - to align with the scrub box. • R move to scrub 1 or 2. • Z move to drop point.
Unload Scrub 1 and Scrub 2	• Theta - must be the same as load scrub 1 or 2. • Delta R to move in to wafer for pick.

continued on next page

Tool Point Tasks, continued

Task	Tool Point
Return Wafer	• Theta - same as pick wafer theta. R difference is R - wafer thickness - paddle thickness.
Index R1 for Return	• Case 1 - 25 (caseof wafer_working).
Index R2 for Return	• Case 26 - 50 (caseof wafer_working).

Tool Point Commands

Command Definitions

Table 9-2. Tool Point Command Definitions

Command/ Abbreviation	Definition
MV	Move
A (MVAX)	Absolute - Measured from absolute home position.
R (MVRX)	Relative - Measured from previous move. (the current position)
Z (MVXZ)	Vertical move - measured in thousandths of an inch.
R (MVXR)	Radial move - measured in thousandths of an inch.
T (MVXT)	Theta rotation move - measured in degrees, minutes, and seconds.
MVAZ,xxx	Absolute Z move.
MVRZ,xxx	Relative Z move.
MVAR,xxx	Absolute R move.
MVRR,xxx	Relative R move.
MVAT,xxx	Absolute Theta move.
MVRT,xxx	Relative Theta move.
HOM	Home Robot (Robot homes at Z = 0, T = 0, R = -5500).
SV	Servo
NA	On

continued on next page

Tool Point Commands, continued

Command/ Abbreviation	Definition
FA	Off
SVNA	Enables Servo
SVFA	Disables Servo
RUP 0	Rotates paddle to vertical.
RDW 0	Rotates paddle to horizontal.
INF1	Returns status after motion. Indicates that communication link with robot remains.
RES	Resets controller (used when conflicts occur. SVNA after this command).
SSP R,Z,T	Set Speed Profile.
SAD R,Z,T	Set Acceleration/ Deceleration (**Do Not Use This Command)**
RCP	Report Current Position.
RHS	Robot Home State. 0 = O.K. 1 = Problem (End Effector Problems).
ABM	Abort Motion.

Robot Positions

Home Positions

The Robot home positions and movements on the Tool are defined in the following ways.

Table 9-3. Home Positions

Task	Tool Point
A	Absolute Genmark home: • Index(encoder) home • Redefined by GAARD (22.5 degrees off of GAARD home)
Not shown	GAARD home: • Position after execution of “HOM” command from Serial I/O window • T = 0, R = -5500, Z = 0
Not shown	Task List Home: • Position after execution of “HOME_ROBOT” task from task list. • T = 18000, R = -8000, Z = 0

Tool Point Variables

Variables

Table 9-4. Tool Point Variables

Variable	Note	Example Value	Description
gBoxT[0]		15500	Theta for cassette 1
gBoxT[1]		20600	Theta for cassette 2
gBoxR[0]	(1)	5245	R for PICK wafer 1 cassette 1
gBoxR[1]	(2)	5215	R for PICK wafer 26 cassette 2
gOffR[0]	(3)	248	Offset for R cassette 1
gOffR[1]	(4)	248	Offset for R cassette 2
gReturnR[0]	(5)	5100	R for RETURN wafer 1 cassette 1
gReturnR[1]	(6)	5050	R for RETURN wafer 26 cassette 2
gBoxZpick		13000	Z for PICK from cassette
gBoxMove	(7)	-250	Delta R for contact in cassette
gBoxZret		12500	Z for RETURN to cassette
gMPT[0]		11220	T for MP1
gMPT[1]		6860	T for MP2
gMPT[2]		29175	T for MP3
gMPT[3]		24840	T for MP4
gMPR[0]		10640	R for MP1
gMPR[1]		10630	R for MP2

continued on next page

Tool Point Variables, continued

Variable	Note	Example Value	Description
gMPR[2]		10630	R for MP3
gMPR[3]		10640	R for MP4
gMPZu[0]		45	Z for MP chuck1
gMPZu[1]		45	Z for MP chuck2
gMPZu[2]		55	Z for MP chuck3
gMPZu[3]		65	Z for MP chuck4
gMPZd[0]		5790	Z for MP unload1
gMPZd[1]		5820	Z for MP unload2
gMPZd[2]		5780	Z for MP unload3
gMPZd[3]		5780	Z for MP unload4
gPinT[0]	(8)	9000	T for ALIGN pins1
gPinT[1]	(9)	27000	T for ALIGN pins2
gPinR		1150	R for ALIGN pins
gPinZ		400	Z for ALIGN pins
gPinMove		-850	Move for align
gPushMove		2710	Move for push

continued on next page

Tool Point Variables, continued

Variable	Note	Example Value	Description
gScrT[0]		18000	T for scrub1 load/unload
gScrT[1]		18000	T for scrub2 load/unload
gScrR[0]	(10)	-7500	R for scrub1 wafer contact
gScR[1]	(11)	-12100	R for scrub2 wafer contact
gScrZ[0]		14800	Z for scrub1 unload
gScrZ[1]		14800	Z for scrub2 unload
gWandR	(12)	130	R Offset for paddle

continued on next page

Tool Point Variables, continued

Tool Points 1 - 12

Table 9-5. Description of Tool Points 1 - 12

Point	Description
1	This is the cassette entry point for a pick of wafer 1. It is the midway point between wafers #1 and #2.
2	This is the cassette entry point for a pick of wafer 26. It is the midway point between wafers #26 and #27.
3	This is the running offset between wafers for cassette 1. Normally has no change between Tools.
4	This is the running offset between wafers for cassette 2. Normally has no change between Tools.
5	This is the precise entry point into the cassette for returning wafer #1.
6	This is the precise entry point into the cassette for returning wafer #26.

Tool Point Variables, continued

Point	Description
7	This is the distance between the entry point to pick and the contact point to start vacuum for picking a wafer from the boat. This offset in R is used for both cassette 1 and 2.
8	This alignment theta for station 1 is angled very slightly towards the left pin (MP1 side) and should be the same side as the freedom of movement for the paddle.
9	This alignment theta for station 2 is angled very slightly towards the left pin (MP3 side) and should be the same side as the freedom of movement for the paddle.
10	This Tool Point is found by moving to the spray box theta and unload Z spray box depth. Then moving in R to find the contact point with the wafer such that when vacuum is ON the paddle has the wafer.
11	This Tool Point is found by moving to the spray box theta and unload Z spray box depth. Then moving in R to find the contact point with the wafer such that when vacuum is turned on the paddle has the wafer.
12	This paddle thickness is calculated using the following formula: Total paddle thickness + total tape thickness (including front and back sides of the paddle). Example: 90mm (paddle) + 20mm (2 layers 10mm tape side 1) + 20mm (2 layers 10mm tape side 2) = 130mm = Typical Green Paddle.

Tool Points

Flow Chart Use flowchart 9631-702182, Tool Points, in the Troubleshooting chapter in this manual, to determine where to begin in the procedure.

Procedures Refer to Setting Gencobot Robot Tool Points in the Calibration and Alignments chapter in this manual, for the procedure to set Tool Points. Refer to “Setting Hine® Robot Tool Points” on page 14-150 to check and set the Hine® robot Tool Points.

NOTE: **Always make sure it is the Tool Point that requires adjustment. Make sure the edge gap is correct, then begin wherever it is appropriate in the procedure.**

Get the appropriate customer required checklists and procedures before entering the Fab to start maintenance work.

Notes:

Chapter 10

Pad Conditioners

Contents This chapter contains the following topics:

Topic	See Page
Introduction	10-2
Components	10-4
Manual Control of the Pad Conditioners	10-5
Conditioner Button (MP Dialog Box)	10-6
Cond Button (Wafer Handling System Dialog Box)	10-9

Introduction

Overview The pad conditioners are located between the MP polish heads on the sides of the Tool. There are two types of pad conditioners available for the Tool, one configuration for metal polish and one for oxide polish.

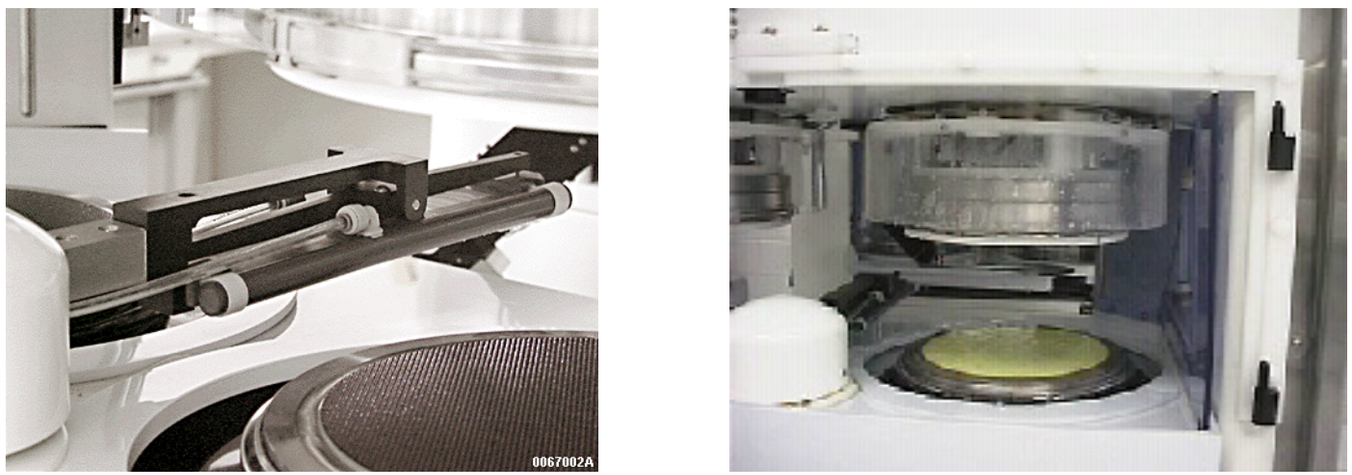

Figure 10-1. Typical Pad Conditioner

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Introduction, continued

Homing

WARNING - MAKE SURE THE HEAD ASSEMBLIES ARE IN THE OPEN POSITION, AND ARE NOT MOVING, BEFORE STARTING THE TOOL. DURING THE HOMING PROCEDURE THE PAD CONDITIONER ARM MOVES BETWEEN THE OPEN HEAD ASSEMBLIES.

When the Tool is first powered on, the pad conditioners are homed. The home position for each conditioner is centered between the two heads the conditioner services.

Purpose

The main function of the pad conditioners is to “rough up” or revitalize the pads after each polish cycle. They also rinse excess slurry and contaminants off the surface of the pads. Each conditioner consists of a controller unit on the high voltage panel, a head assembly attached to the top of the motor, and a brush arm assembly which contains the pad brush and DI water lines. The controller units on the Pad Conditioner high voltage panel assemblies inside the Electrical Cabinet control the movement of each pad conditioner.

Metal Pad Conditioner

After a polish cycle, when the wafer has been removed from the polish pad, the pad conditioner arm moves over the polish head, lowers the brush onto the polish pad, and begins a series of side to side sweeps. The action of the bristles “roughs up” the pad and rinses the contaminants away. After conditioning, the arm raises and rotates back to its home position.

continued on next page

Introduction, continued

Oxide Pad Conditioner

After a polish cycle, when the wafer has been removed from the polish pad, the pad conditioner arm moves over the polish head, lowers onto the polish pad, and begins a series of side to side sweeps. The oxide pad conditioner uses the same side to side sweeps as the metal process pad conditioner, but the contact surface does not have bristles, it is more like sand paper with a bladder behind it, that inflates to give added force. For optimal results, SpeedFam-IPEC recommends that the polish head is in motion during conditioning.

Components

Head Assembly	The head assembly is the attachment point for the base of the brush arm to the servo motor unit. It contains the pneumatic lines and switches necessary to raise and lower the brush arm onto the polish pad. It also routes DI water lines out to the brush arm for rinsing during the conditioning process.
Metal Polish Brush Arm	The brush arm is the actual contact point to the polish pad. This assembly consists of a sectioned metal arm which is attached to the base of the head assembly. On the bottom of the arm a special non-contaminating fiber brush is attached to scrub the polish pad. Along the top of the arm, on each side, spray lines are attached from the base to the tip of the arm. Ports in these lines release a spray of DI water to rinse away pad particles during the cleaning process.
Oxide Polish Brush Arm	Like the metal polish brush arm, the oxide brush arm also is the actual contact point with the polish pad. The oxide brush does not have the bristled brush, it has a sandpaper like surface with an inflatable bladder behind it to give additional downforce. It is recommended that the polish head be in motion for optimal results during the condition
Stepper Motor	The head assembly is attached to the top of the motor and gearbox.
High Voltage Panel	The stepper motor is governed by a programmable logic controller or PLC. This PLC is located on the pad conditioner high voltage panel in the Electrical Cabinet. The PLC interprets incoming signals from the computer to determine which program to run.

Manual Control of the Pad Conditioners

Introduction The pad conditioners can be run manually from the MP dialog box or from the Wafer Handling System dialog box. The condition cycle can be edited from these boxes, but only while the maintenance activity being done. Changes made will not affect the Tool during production.

Conditioner Button (MP Dialog Box)

Function

CAUTION - This dialog box is used to set up the parameters associated with doing manual conditioning only, meaning the manual condition run button. These parameters will not be used during processing for any conditioning step in the process recipe. The recipe step defines process conditioning only.

Displays the manual conditioning parameters for the MP head. This includes manual conditioning request, pressures, sweeps, and pump flows. Refer to Table 10-1 for a description of the controls in the Condition Parameters dialog box.

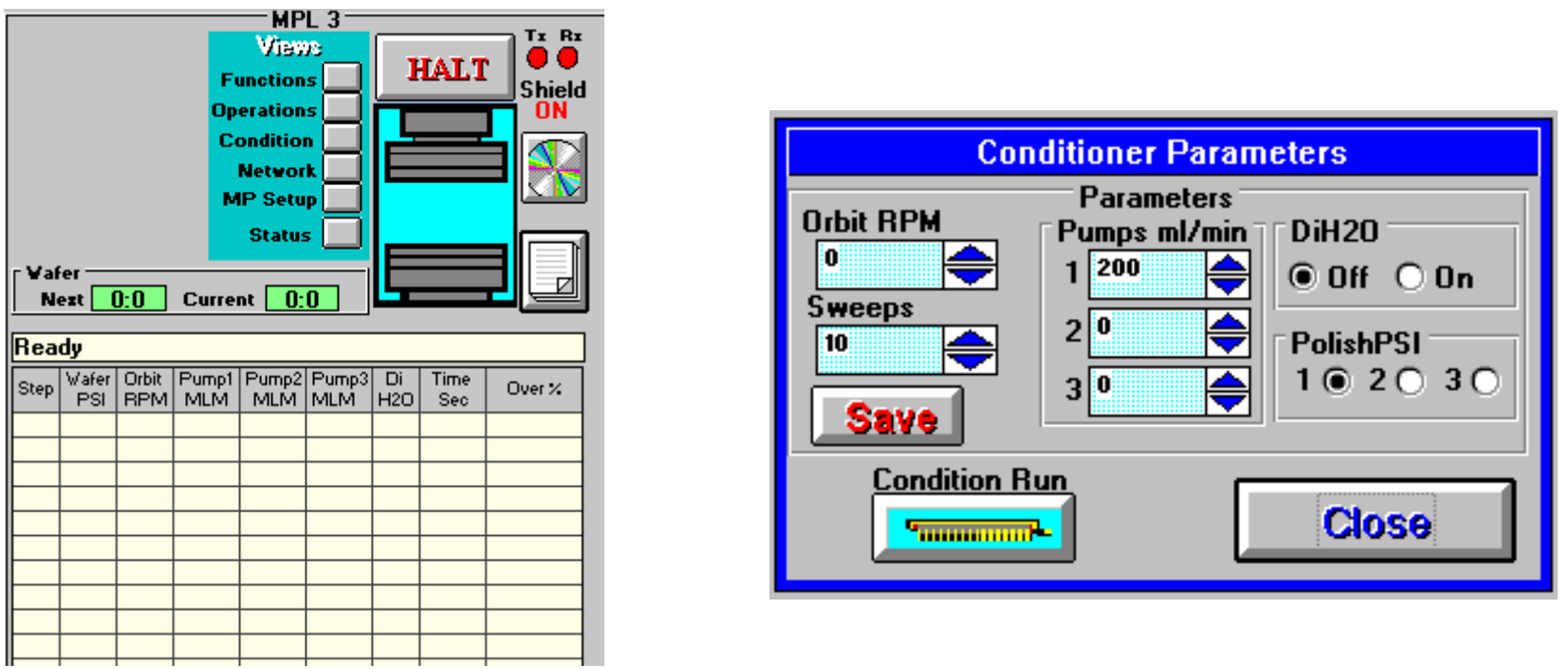

Figure 10-2. Condition Button (MP Dialog Box) and Dialog Box

continued on next page

Conditioner Button (MP Dialog Box), continued

User Access Owner and Expert level have complete access.

Restrictions Operator level only has condition run access.

Button is not available with No User Login, non-initialized heads and during wafer processing on the MP.

continued on next page

Conditioner Button (MP Dialog Box), continued

Conditioner Parameters

See Figure 10-2 for the Condition Button on the MP dialog box and the Conditioner Parameters dialog box.

Table 10-1. Conditioner Parameters Buttons Description and Function

Button	Description
Orbit RPM	Allows the polish head to orbit from 0 - 350 RPM during a manual pad conditioning.
Sweeps	Sets the number of sweeps the pad conditioner will do. Allowed range is 0 - 99 sweeps.
Pumps • (Pump) 1 • (Pump) 2 • (Pump) 3	Allows setting of a pump value (ml/min) to be pumped during pad conditioning. Arrow Spin Up/Down buttons - Allows value entries from 0 - 300 ml/min in 10 ml/min adjustments. • Pump 1 - Activates Slurry Pump 1 - DiH2O. • Pump 2 - Activates Slurry Pump 2 - Primary Slurry. • Pump 3 - Activates Slurry Pump 3 - Secondary Slurry.
DiH_2O	ON - Starts the flow of DiH_2O to the polish head during pad conditioning. OFF - The flow of DiH_2O to the polish head is OFF during pad conditioning.
Polish PSI	Enables polish head pressure during pad conditioning. From 1 to 3 psi in 1 psi increments can be selected.

Cond Button (Wafer Handling System Dialog Box)

WARNING - ONLY ACTIVATE THESE COMMANDS FROM THE MAINTENANCE MONITOR, AND IN FULL VIEW OF THE EQUIPMENT TO BE OPERATED. ATTEMPTING TO RUN IN MANUAL MODES FROM THE BAY CAN CAUSE SERIOUS INJURY TO MAINTENANCE PERSONNEL NOT SEEN BY THE OPERATOR.

Function Displays the manual Conditioner Functions dialog box. This includes homing, parking, and arm activities. Refer to Table 10-2 for a description of the controls in the Condition Functions dialog box.

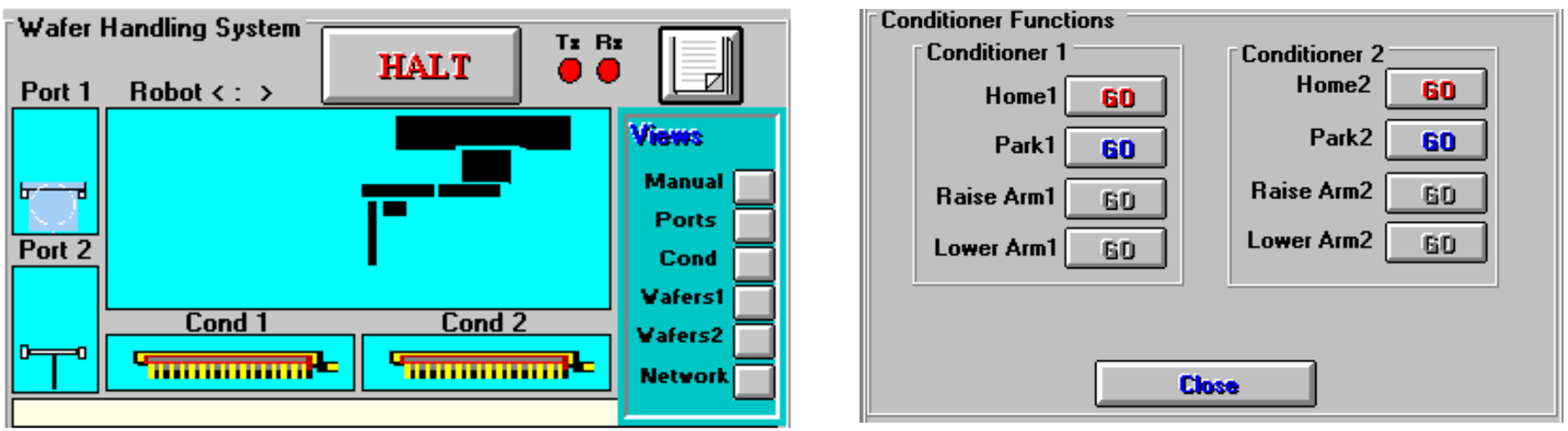

Figure 10-3. Wafer Handling System and Conditioner Functions Dialog Boxes

continued on next page

Cond Button (Wafer Handling System Dialog Box), continued

User Access	Owner and Expert level have complete access. Operator level has no access.
Restrictions	Button is not available with No User Login, a non-initialized Wafer handling system and during wafer processing.

continued on next page

Cond Button (Wafer Handling System Dialog Box), continued

Conditioner Functions

See Figure 10-3 for the Cond Button on the WHS dialog box and the Conditioner Functions dialog box.

Table 10-2. Conditioner Functions Buttons Description and Function

Button	Description
Home 1 or 2	Requests the specified pad conditioner to Home which includes a Park.
Park 1 or 2	Requests the specified pad conditioner to Park only.
Raise Arm 1 or 2	Commands the specified conditioner arm to raise.
Lower Arm 1 or 2	Commands the specified conditioner arm to lower.

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